MARITIME NETWORKS IN THE MYCENAEAN WORLD

THOMAS TARTARON

CAMBRIDGE

Maritime Networks in the Mycenaean World

In this book, Thomas F. Tartaron presents a new and original reassessment of the maritime world of the Mycenaean Greeks of the Late Bronze Age. By all accounts a seafaring people, they enjoyed maritime connections with peoples as distant as Egypt and Sicily. These long-distance relationships have been celebrated and much studied; by contrast, the vibrant worlds of local maritime interaction and exploitation of the sea have been virtually ignored. Tartaron argues that local maritime networks, in the form of "coastscapes" and "small worlds," are far more representative of the true fabric of Mycenaean life. He offers a complete template of conceptual and methodological tools for recovering small worlds and the communities that inhabited them. Combining archaeological, geoarchaeological, and anthropological approaches with ancient texts and network theory, he demonstrates the application of this scheme in several case studies. This book presents new perspectives and challenges for all archaeologists with interests in maritime connectivity.

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Dedicated to the memory of my father,
Francis X. Tartaron, Jr.

CONTENTS

FIGURES

TABLES

PREFACE

This book is inspired by a keen interest in coastal archaeology, cultivated during twenty years of fieldwork in coastal regions of mainland Greece. Over this time, I have collected empirical data from three regional landscape archaeology projects with extensive coastal components: the Nikopolis Project (1991–95), the Eastern Korinthia Archaeological Survey (1998–2002), and the Saronic Harbors Archaeological Research Project (2007–11), which have allowed me to address Mycenaean coastal exploitation at multiple spatial and temporal scales. As I worked through these data and tried to arrive at a more comprehensive understanding of coastal life, I became increasingly aware of, and frustrated by, the gaps in our knowledge about coastal exploitation in the Mycenaean period and the selective treatment it has received in the scholarly literature. It seemed that local-scale maritime networks were only rarely discussed, and that the coastal communities that participated in them were largely ignored. The topic deserves more comprehensive, systematic treatment than it has received to date. This book constitutes my attempt to suggest a refocused and more holistic research agenda. The elements of this approach are both conceptual and methodological, but perhaps most importantly, they must be transferable to practice in the field, where only by generating robust empirical data can we begin to close this knowledge gap. Accordingly, I offer one detailed case study and two "sketches" to demonstrate the application of this approach and to suggest some directions for future research. I hope to make a helpful contribution to Aegean Bronze Age archaeology, but I also intend this work to be sufficiently general that archaeologists working on maritime and coastal problems in any world area might find it useful in their own investigations.

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My love of coastal archaeology has been nurtured over two decades along the shores of Epirus and the Corinthia. I am grateful first to the directors of the Nikopolis Project (James Wiseman and Kostas Zachos) and the Eastern Korinthia Archaeological Survey (Timothy Gregory and Daniel Pullen) for allowing me to indulge my interests. I want especially to recognize Daniel Pullen, with whom I co-direct the Saronic Harbors Archaeological Research Project, who has been an extraordinary colleague and friend. The fundamental ideas about coastscapes and small worlds are ones we crafted together, and he has been unfailingly supportive of me during the gestation of this book and my concurrent progress toward academic tenure. Over the years, Heather Lechtman, Curtis Runnels, and Jeremy Rutter have been mentors whose intellectual influence on my work has been great. Cyprian Broodbank is a colleague whose work has had a tremendous impact on my thinking, as will be evident in the following pages. All of these collaborations have blossomed into long-term associations and friendships that I value deeply.

In the field, I have had the privilege of working together with a remarkable group of geoarchaeologists, including Mark Besonen, Joe Boyce, Rick Dunn, Zhichun Jing, Jay Noller, Rip Rapp, Ed Reinhardt, Richard Rothaus, Tjeerd van Andel, Lisa Wells, and Eberhard Zangger. My understanding of coastal geomorphology and paleocoastal reconstruction has been the direct result of their patient and benevolent teaching, and their broad-minded approach to the interaction of environment and culture. Because I constantly stress the importance of high-quality empirical data, I want also to thank all of the professionals, students, and volunteers – far too many to name here – who walked the fields, mapped the features, and collected the artifacts and other data that form the basis for the kind of study presented here.

No fieldwork can take place in Greece without the support of the regional archaeological authorities. In all of the above-named projects, our teams were fortunate to have the assistance and backing of the relevant ephorates. For the Saronic Gulf case study presented in this book, Daniel Pullen and I enjoyed a fruitful and harmonious collaboration with Konstantinos Kissas, Panayiota Kasimi, and Vasilis Tasinos of the 37th Ephoreia of Prehistoric and Classical Antiquities; and Demetrios Athanasoulis of the 25th Ephorate of Byzantine Antiquities, both in Corinth. I want especially to recognize Panayiota Kasimi, herself an expert in Mycenaean archaeology, for her firm but always collegial oversight of our project. The kindness and support of the people of Korphos have also been unforgettable. We fell in love immediately with this beautiful fishing village and its people, who accepted us, helped us, told us their stories, and supported our efforts to uncover a lost piece of their cultural heritage.

The bulk of this book was written while I was on leave from the University of Pennsylvania in 2009–10, with the generous support of the Loeb Classical Library Foundation and the School of Arts and Sciences of the University of Pennsylvania. I thank my wonderful colleagues in the Department of Classical Studies, who gave advice and other forms of support as I toiled to bring this project to a successful conclusion.

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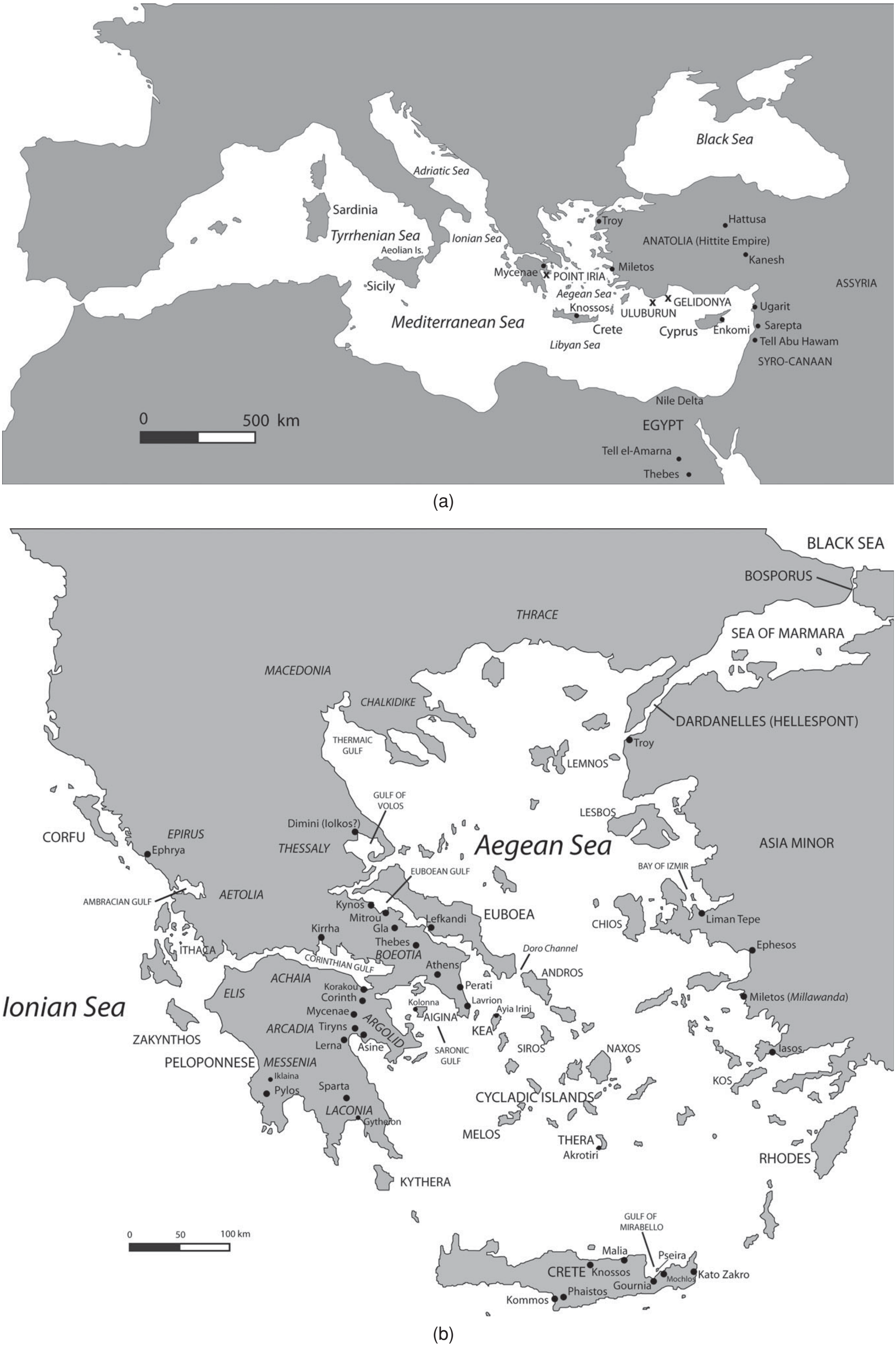
ONE

THE PROBLEM OF MYCENAEAN COASTAL WORLDS

The archaeological, textual, and iconographic evidence for the Late Bronze Age (LBA) eastern Mediterranean indicates that the Mycenaeans of mainland Greece and the Aegean islands were a seafaring people and key participants in economic and political interactions with Egypt and the Near East, channeled through extensive maritime connections (Fig. 1.1; Table 1.1). The premise of this book is that despite an apparently rich record of engagement with the sea, and the keen interest scholars have shown in elucidating it, we remain surprisingly ignorant about many of its aspects. First, we know little about where Mycenaean anchorages and harbors were, or how they were used. Second, although much attention has been devoted to long-distance "international" connections with the states, empires, and emporia of the eastern Mediterranean, comparatively little consideration has been extended to networks of maritime relations operating at regional and (especially) local scales within the Mycenaean world. Third, we currently lack a systematic body of method and theory to allow us, on the one hand, to identify and reconstruct the coastal nodes and maritime routes that made up small- and medium-scale networks; and, on the other hand, to understand how they functioned within the broader social, political, and economic realities of their day.

This work offers a close examination of these lacunae, with three specific aims: (1) to present a more balanced picture of maritime interactions, emphasizing that small- and medium-scale connections are more representative of the activities of most Mycenaean coastal communities than long-distance voyaging; (2) to present a set of concepts and methods for identifying and interpreting evidence for coastal exploitation and maritime interaction; and (3) by means of case studies, to illustrate the practical applications of these ideas and to advocate for new directions in research on Mycenaean "coastal worlds."



1.1 (a) Map of the Mediterranean; (b) detail of the Aegean region, showing the main regions and sites mentioned in the text.

Table 1.1. Chronological framework for the Aegean Bronze Age

	Crete (Minoan)		Mainland (Helladic)		
	Pottery phase	Calendar dates	Pottery phase	Calendar dates	
Prepalatial	Early Minoan (EM) I	3100–2700	Early Helladic (EH) I	3100–2700	
	EM II	2700–2200	EH II	2700–2200	
	EM III	2200–2100	EH III	2200–2000	
	Middle Minoan (MM) IA	2100–1900	Middle Helladic (MH) I	2000–1850	
Protopalatial	MM IB	1900–1800			
	MM II	1800–1700	MH II	1850–1700	
Neopalatial	MM III	1700–1600	MH III	1700–1600	Shaft Grave Era
	Late Minoan (LM) IA	1600–1480	Late Helladic (LH) I	1600–1500	
	LM IB	1480–1425			
Final Palatial	LM II	1425–1390	LH IIA	1500–1440	Mycenaean
			LH IIB	1440–1390	
	LM IIIA1	1390–1370	LH IIIA1	1390–1370	
Postpalatial	LM IIIA2	1370–1300	LH IIIA2	1370–1300	
	LM IIIB	1300–1190	LH IIIB	1300–1190	
	LM IIIC	1190–1070	LH IIIC	1190–1070	
	Subminoan	1070–1000	Submycenaean	1070–1015	

An Archaeological and Historical Problem

At the outset, it will be useful to define some of the terms and concepts fundamental to this study to banish, as much as possible, ambiguity from the arguments and to reveal the assumptions that underlie them. As each section unfolds, further concepts will be defined in a similar way.

To begin with a basic question, what is the overlap, if any, in the terms *ship* and *boat*? In practice, for maritime historians and archaeologists the difference resides simply in size and complexity (McGrail 2006: 60), and there is no clear boundary or threshold in these properties that marks the transition from one to the other. Alternative distinctions, such as open-seaworthiness or specific function, are no more than general rules of thumb that cannot be sustained if applied too rigorously. We know from countless ethnographic and historical examples in the South Pacific and elsewhere that small, simple vessels are used regularly for long, open-sea journeys, and similar boats made lengthy open-sea crossings as early as 40,000 years ago when the continent of Australia was first colonized. Therefore, while conceding the general pattern that small boats are used primarily for shorter-distance coast-hopping or navigation of rivers and inland waterways, larger ships may be used for those same purposes and small boats might venture on long journeys. Similarly, function must be demonstrated and not assumed, so associating a narrow set of functions with a particular hull

type can be misleading or wrong. Care should be taken when using terms that embed function, such as *warship* or *trading vessel*, to allow for multifunctional or hybrid designs. In this study, the generic terms *vessel* and *craft*, which carry no implication of size, complexity, or function, will often be used in ambiguous cases or when a comment applies equally to ships and boats.

The coastal nodes of a Mycenaean maritime network might be characterized using such terms as *anchorage*, *harbor*, or *port*, which though sometimes used interchangeably, will have specific definitions for our analysis. An anchorage is any coastal location at which a vessel can be brought to a safe landing position, by any means including being pulled up onto a sandy shore, lying at anchor in shallow offshore waters, or being moored to a natural feature or an artificial construction such as a quay or jetty. There is no necessary implication in this term of the existence of durable, artificial constructions to accommodate vessels, or of a permanent settlement associated with these activities. Many anchorages, past and present, are used episodically, often tied seasonally to environmental conditions and agricultural calendars and providing temporary safe haven in times of danger at sea. The term *harbor* carries the stronger implication that certain coastal locations are earmarked for the role of accommodating maritime traffic. The morphological attributes of harbors range from entirely natural embayments with few or no artificial constructions to enhance their maritime functions, to fully artificial harbors fashioned by means of breakwaters, quays, and elaborate drainage and maintenance systems. Still, there is no requirement that a permanent settlement accompany a harbor, although the greater the maritime traffic or the number of artificial enhancements, the more likely that this will be the case. The connotation of the term *port*, finally, is of the existence of a "port town," thus a permanent settlement with a primary function as a major node in a maritime network. The port town typically possesses more than the bare essentials to accommodate maritime traffic: there may be complex facilities for storage, recording, and exchange of commodities; processing of raw materials; transshipment to interior regions or further seaward destinations; and quartering of crews for short- or longer-term residence. These three terms are hierarchical in the sense that ports by definition incorporate the properties of harbors and anchorages, whereas harbors are also anchorages. It is important to retain clear distinctions because this relationship may not work in the other direction: by these definitions, anchorages may not be harbors and harbors may not be ports. These distinctions will be useful for determining the roles and facilities that were or were not present in a given case.

The problem of locating the coastal nodes described by these terms arises from a set of interrelated factors that together engender low archaeological visibility. Unlike later commercial and military harbors of Greek and Roman

times, evidence that the Mycenaeans built permanent harbor installations with features such as quays, breakwater structures, lighthouses, or even artificial harbors (Marriner and Morhange 2007) is decidedly lacking. It remains entirely possible that Mycenaean sailing ships, along with smaller boats powered by oars or paddles, were pulled onto sandy shores or anchored off the coast, as depicted in the somewhat earlier "Flotilla Fresco" in the West House at Akrotiri on the island of Thera (Morgan Brown 1978; Warren 1979), largely without the use of built harbor constructions that would leave archaeological traces.

An equally significant obstacle to identifying these locations is geomorphological change since the Bronze Age. Modern Aegean coastlines are poor indicators of their configuration in the Mycenaean era. Global sea-level rise affects the Aegean modestly, on the order of +3 to 5 meters since the Bronze Age (Lambeck 1995, 1996). Potentially more transformative are catastrophic tectonic events that cause coasts to lift up or subside. Greece lies in a zone of contact between two tectonic plates (the African and Eurasian) whose interaction shapes the Greek land mass and archipelago through deep fault systems, earthquakes, volcanism, and orogenesis. The consequences of tectonically induced uplift and subsidence can be notoriously localized; thus, there is no valid pan-Aegean model for the changes in form and *relative* sea level on a given segment of shoreline. Another group of anchorages, including river mouths, deltas, and lagoons/estuaries, has disappeared through sedimentation caused naturally and often accelerated by human activities. In view of the complexities of coastal change, any comprehensive study of Aegean Bronze Age coastlines requires integrated programs of coastal geomorphology and archaeology, with both terrestrial and underwater components. Specifically, the archaeological methodology espoused here closely integrates methods of detection (remote sensing, Geographic Information Systems, archaeological and geoarchaeological surface survey) with subsequent investigation (terrestrial and underwater geology, extensive and intensive survey, terrestrial and underwater excavation, ethnography and oral history). As we shall see, the results of such analyses tend not to be broadly valid beyond the immediate settings under study.

There is also a lack of clarity, and a strong bias, concerning the scale and nature of Mycenaean maritime interaction. Scholarly interest tends to focus on long-distance voyaging, involving the exchange of elite goods and raw materials of vital interest to the palaces, such as copper and tin. The image of Mycenaean trading fleets sailing around the eastern Mediterranean, putting in at major ports, is alluring but surely misleading. We are not certain that Mycenaean ships routinely sailed to Egypt, for example, rather than obtaining Egyptian goods at emporia like Ugarit on the Syrian coast, or from ships visiting Greece from the east. More importantly, such long-distance connections were dwarfed in quantity by dense networks of local and regional maritime connections among

Mycenaean communities. The latter routes and relationships have received little attention, but they must have dominated the use of anchorages, large and small, on Aegean coasts.

There were many shades of activity in the spectrum between local and international interaction. Local and microregional maritime networks are best expressed by the concept of the "small world" (Broodbank 2000: 175–210), composed of communities bound together by intensive, habitual interactions due to geography, traditional kinship ties, or other factors. There may be a high level of interdependence and communities may come to think of themselves as forming a natural entity, defined by the dense web of connections that supports a combination of political, social, and economic relationships. Small worlds are nested within larger regional and interregional economic and sometimes political networks. Small worlds evolve and change over time, as I seek to demonstrate in a diachronic reconstruction of a Bronze Age small world in the Saronic Gulf (Chapter 7). The inhabitants of Kolonna on the island of Aigina dominated this small world of coastal settlements for nearly a millennium, until the expanding palace at Mycenae broke it apart, incorporating Saronic communities into broader Aegean networks. Within that millennium, however, it is possible to detect waxing and waning of the relationships of small coastal settlements with each other and with Aigina as the attention of Kolonna's inhabitants shifted into and away from the Gulf.

Moving beyond the local context, regional-scale networks within the Mycenaean world are typically measured by the distribution of imported artifacts. Often, it is possible to trace the movements of durable commodities through stylistic analysis (e.g., of painted pottery) or through archaeometric analyses that isolate physico-chemical "fingerprints" by which an artifact's place of origin can be identified. The connections thus recognized between centers and regions may be direct or indirect, and may involve the movement of goods and ideas without the implication of strong political ties or asymmetrical power relationships. For example, during the Mycenaean period the northern Corinthia exhibits clear affinities to the Argolid in material culture classes including architecture and pottery, but virtually all of the painted fineware that emulates Argive types was made locally (Morgan 1999: 349–61). In spite of a long scholarly tradition that Mycenae dominated the entire Corinthia politically, inspired in part by the Homeric catalogue of ships, there is little evidence to support this claim (Pullen and Tartaron 2007; Tartaron 2010). Nevertheless, the growth of Mycenaean states did involve expansion into adjacent territories by economic, political, and, most likely, military means. This diachronic process has been fleshed out from excavation, survey, and mortuary data for the palatial centers at Pylos (Bennet 1999; Bennet and Shelmerdine 2001) and Mycenae (Cherry and Davis 2001; Tartaron 2010; Voutsaki 1995, 1998, 1999; Wright 2004).

Defining Mycenaean Coastal Worlds

A central concept of this book is the "Mycenaean coastal world." The term *Mycenaean* itself is in need of deconstruction, since it is variously used to describe a chronological period (the Late Bronze Age or Late Helladic [LH] period, c. 1600–1050) occurring in a geographical area (the central and southern Greek mainland and some Aegean islands) with fuzzy and shifting boundaries, a widespread style in material culture (architecture, iconography, pottery forms, etc.) that is said to achieve a kind of *koiné* in the high palatial period of LH IIIA2–early LH IIIB (roughly, 1370–1250), a complex sociopolitical system based on the palaces and recorded using a syllabic script (Linear B) that represents an archaic form of the Greek language, and sometimes even an ethnicity, a particularly problematic construct for a prehistoric world. Each of these senses of the term has provoked debate. Quite apart from the challenge of fixing chronometric dates based on radiocarbon determinations or synchronisms with Egyptian and other calendars, it is not altogether obvious when the Aegean became Mycenaean or when it ceased to be so. For instance, do we mark the end of the Mycenaean world with the collapse of the palaces circa 1200 BC, or do we recognize that Mycenaean people and their material culture traditions persisted for more than a century afterward, even experiencing a kind of revival in LH IIIC Middle (Thomatos 2006)? In fact, the picture is variable: sharp endings at some centers and in some regions; long twilights elsewhere.

A similar lack of sharp boundaries attends the geographical extent of the Mycenaean world, and here the issue is sometimes framed as a search for the "limits" or "boundaries" of the Mycenaean culture area, as manifest in attenuation of material or material culture traits (Kilian 1990). A good example is the attempt to define a series of zones and boundaries in Thessaly marking incremental cultural distance from the Mycenaean world (Feuer 1983, 1994). As coarse tools, these can be useful, though drawing boundaries can be a misleading exercise, for the obvious reason that the spatial pattern of participation in Mycenaean culture is far more complex than a set of map polygons within which uniform cultural engagement is implied (Galaty and Parkinson 2007: 8–9; Tartaron 2004: 165–67). Ongoing discoveries in the Bay of Volos area are pressing the question of whether coastal Thessaly was "Mycenaeanized" or fully Mycenaean (i.e., having no fundamental cultural differences from Mycenaean centers in the Argolid, for example), the latter having been claimed recently by Vasiliki Adrimi-Sismani (2007).

This discourse begs the question, of course, of whether there *can be* a list of material and cultural traits by which to include or exclude a settlement or region as Mycenaean, and what measure of "drift" from such a trait list is tolerable for inclusion. This approach assumes the existence of a "core area" comprising the Peloponnese and central Greece, which shared most aspects of material culture

and practice: pottery forms and decoration; domestic, military, sacred, and mortuary architecture; and common practices reflected in agropastoral economies, ritual practice, and burial customs. By implication, those living outside the core area were not Mycenaean, though some will have been "Mycenaeanized" by contact or colonization.

The point of view taken in this book is that while it is possible, and at times even useful, to identify a core area in which aspects of Mycenaean material culture and practice were broadly shared, such a zone was neither monolithic in cultural or geographic terms, nor static over time. If the standard is the material culture of the palaces, or that of a specific region such as the Argolid, then places "between and beyond" participated to varying degrees over time subject to local conditions such as accessibility and social organization (Tartaron 2010). The trouble with normative representations of the Mycenaean world based on trait lists and stylistic attributes is that they give a false impression of uniformity within the core area by suppressing the local and regional variability on which an illuminating and culturally rich narrative of interaction might be based. Those studying frontier areas in Thessaly or distant pockets of Mycenaean coastal presence elsewhere have challenged the sharp Mycenaean/non-Mycenaean cultural dichotomy, but just as important is the realization that a comparable dynamic of accommodation, resistance, and negotiation – to borrow the words of Andrew and Susan Sherratt (1998: 330), "an organic process of cultural encounter and dialectic" – was occurring in the heartland of the Peloponnese and central Greece.

The notion of "coastal worlds" is rendered in the plural to emphasize two closely related points. First, at any given coastal location, diachronic change is inevitable. With the passage of time, any coastal area may experience geomorphic or topographic change, foundations and destructions, reorientation of relationships and connections, and many other transformations. Therefore, Bronze Age coastal history is a complex narrative, not merely a series of fixed points on a map or a normative characterization that masks changes over centuries or millennia. Thus, for any coastal area that we study, we must deploy diverse perspectives and analytical tools and we must find a way to represent its dynamism.

Second, the term signals my alignment with certain postmodern ideas about landscape, particularly the notion that a multiplicity of culturally constructed landscapes constitutes the experiences of different sets of actors at any given place and time (Anscheutz et al. 2001; Ashmore and Knapp 1999). Properly conceived, this perspective does not ignore the realities of the physical world in which people live, or the role of environment in shaping human societies, but in an important way it allows us to address the varied perceptions, ideas, and cultural notions that allowed coastal dwellers to construct a comprehensible world. For instance, Mycenaean sailors had a need to compose a multifaceted

maritime world of coastscapes, islandscapes, and seascapes in order to interact with the natural forces of sea and sky, and with the people and places they encountered en route – indeed, to survive. Apart from practical knowledge of ship technology, navigation, and environmental conditions such as currents and winds, ship captains needed to carry a mental map of landmarks, seamarks, and safe anchorages along a series of potential routes. This information was constituted in a symbolic world of named features, places, and meteorological forces; that is, a "habitus" (Bourdieu 1990) of maritime knowledge passed from one generation of seafarers to the next. In the characters and places of Homer's post–Bronze Age *Odyssey*, both realistic and fantastical, we may discern traces of a seafarer's phenomenology. At all times, the sea inspired ambivalence, with its paradoxical roles as giver of bounty (fish, exotic objects and ideas) and taker of lives.

These diverse theoretical strands come together in the concept of the "coastscape" (Pullen and Tartaron 2007), inspired by a postmodern interpretation of landscape and serving as the main analytical and interpretive lens for maritime coastal activity at the local scale. The coastscape takes its place among the constellation of specialized rubrics derived from landscape archaeology and applied to the maritime context, including "islandscapes" (Broodbank 2000: 168–76; Frieman 2008; Rainbird 2007) and "seascapes" (Cooney 2003). From the land-based perspective of a modern, urbanized world of paved roads and mechanized vehicles, coasts are often seen as peripheral, linear and narrow, and liminal or transitional. In a coastscape perspective, however, coasts have a certain centrality as meeting places between the sea and the interior. They are nodes of connectivity and integrative spaces, and as such they were historically privileged locations while at the same time exposed to dangers from both land and sea. This exposure contributed to complex historical sequences. In short, coastal spaces were hotspots in the Bronze Age that witnessed the interactions of everyday life, but also provided the setting for pivotal events and for the exchange of ideas that stimulated profound change. It is possible, therefore, to write an alternative narrative in which coastlines are central settings for economic and social history.

A final, yet crucial, point is that coastal worlds are not merely the linear feature of the coastline or the anchorages and settlements that might be found there. They also encompass offshore waters with their opportunities and dangers, the full visual field (i.e., viewshed) of a coastal location, the arteries connecting the coast to the interior and its resources and people, and the dense network of local maritime connections that constitute the coastal world. In the Mycenaean palatial period, a coastal settlement could access the productive capacity of the interior hinterland, while at the same time functioning as a node oriented primarily to the sea and the Mycenaean maritime economy.

Organization of the Book

The book consists of eight chapters. In Chapter 2, "Mycenaeans and the Sea," after a brief summary of the cultural and historical background of the Mycenaean period, I examine the geographical and chronological patterns of Mycenaean maritime activity in the Mediterranean, and then outline the relevant categories of evidence, with comments on each. Chapter 3, "Ships and Boats of the Aegean Bronze Age," outlines the salient features that are known or can be inferred about Bronze Age seacraft, using a range of physical, iconographic, textual, and ethnographic evidence. An attempt is made to trace the evolution of different hull types and to assess their performance characteristics, including the smaller boats that should have been the workhorses of local-scale maritime connectivity. In Chapter 4, "The Maritime Environment of the Aegean Sea," I analyze the full range of environmental phenomena, from global to local, that combined to generate the conditions of seafaring and coastal habitats. Further, I discuss the practices of navigation in the Aegean and the formation and perpetuation of maritime communities and their specialized knowledge. Chapter 5, "Coasts and Harbors of the Bronze Age Aegean: Characteristics, Discovery, and Reconstruction," outlines the environmental processes of coastal evolution over the last 6,000 years in the Mediterranean, and their impact on Aegean coastlines. I emphasize the need for programs of paleocoastal reconstruction at the local scale and present the elements of a rational field methodology for recovering Aegean Bronze Age anchorages. The aim of Chapter 6, "Concepts for Mycenaean Coastal Worlds," is to provide a theoretical framework for a multiscalar model of Mycenaean maritime interaction. This model consists of four distinct but nested maritime interaction spheres: the coastscape, the small world, the regional/intracultural maritime interaction sphere, and the interregional/intercultural maritime interaction sphere. Social network analysis is advocated as a means to understand connectivity at these different scales. Chapter 7, "Coastscapes and Small Worlds of the Aegean Bronze Age: Case Studies," puts these concepts and methods to work in one detailed (the Saronic Gulf) and two less detailed (Miletos/Latmian Gulf, Dimini/Bay of Volos) case studies. In each example, paleocoastal reconstruction was a key element in reconstituting the physical setting of coastscapes that were embedded to varying degrees over time in small-world networks. Archaeological evidence is used to track the waxing and waning of these small worlds and to measure their participation in larger-scale connectivity. The concluding Chapter 8 revisits the main themes – theoretical, methodological, and applied – and attempts to summarize my position on how Mycenaean coastal worlds can be both reconstituted and rethought.

The central goal of this book is to advocate for a reorientation of our intellectual energies away from international-scale maritime relations, toward the

scale of the coastscape and the small world, not because there is no more to learn from *le grand trafic maritime*, but because a wealth of information about the preponderance of maritime lives and interactions remains largely untapped. Building on the work of many others before me (e.g., Braudel 1972; Broodbank 2000; Horden and Purcell 2000), I recommend a set of conceptual and methodological tools with which to rationalize and systematize the task of drawing out this information. If we wish to achieve a holistic understanding of Mycenaean maritime activity, and particularly if we hope to offer Aegean Bronze Age data as cross-cultural comparative material (Parkinson 2010; Parkinson and Galaty 2009b: 11–22), we ought to build up from local-scale coastscapes and networks – a "bottom-up" approach – so that interregional trade is not disembodied from its own social and cultural realities.

TWO

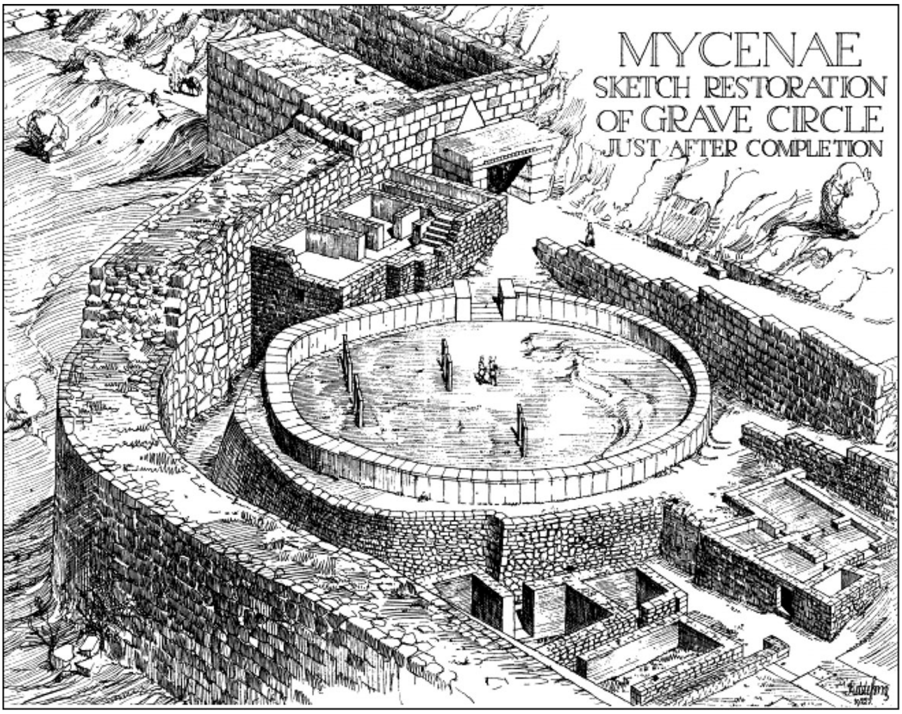
MYCENAEANS AND THE SEA

In this chapter, I establish the necessary evidentiary background for the study of Mycenaean maritime activity. I begin with a brief historical sketch of the Mycenaean period, charting the emergence, growth and prosperity, and decline and collapse of complex society on the Greek mainland. Next, I summarize the geographical and temporal variability of Mycenaean maritime activity in the Aegean and beyond, and comment on the nature of those interactions. Finally, I describe and evaluate the main sources of evidence for maritime activity that will be applied in subsequent chapters.

A Brief Historical Sketch of the Mycenaean Period

Emergence of Mycenaean Civilization

The first signs of the emergence of complex society on the Greek mainland during the Bronze Age occurred with the precocious appearance of wealth and social differentiation in the shaft graves at Mycenae (Fig. 2.1), roughly contemporary with the neopalatial Minoan palaces on Crete (see Fig. 1.1, Table 1.1). The richness and quantity of the imported goods buried with the dead are especially striking against the background of a materially poor Middle Bronze Age (MBA; Rutter 2001, pp. 124–47, 151–55). This conspicuous consumption and display of exotic wealth is seen as a deliberate strategy to proclaim status through access to distant lands and their luxury materials (Voutsaki 1995, 1998, 1999, 2001). Because the exotic objects and pictorial art of the shaft graves show close ties with Minoan Crete, at that time at the apex of its neopalatial prowess, it has often been suggested that small groups of nascent elites on the mainland cultivated a "special relationship" with one or more Minoan palaces



2.1 Artist's reconstruction of Grave Circle A, as it appeared at Mycenae circa 1210 BC. Drawing by Piet de Jong, *Annual of the British School at Athens* 25: plate XVIII. Reproduced with the permission of the British School at Athens.

to gain access to exotic materials and artisans. The Minoan influence is certainly real and even profound in some areas, including iconography, ceramic forms and styles, metalworking, and to some extent funerary architecture, but the graves and their furnishings betray many other sources and craft traditions, including Anatolian and Egyptian, but more prominently of local or other mainland origin. Still, Minoan expansion may have been the catalyst for this transformation: the influx of Minoan and Cycladic goods disrupted the egalitarian social structures of Middle Helladic (MH) Greece with novel ideas and ways to distinguish oneself through the creation and expression of prestige (Voutsaki 1999, 2010). These new objects and styles were put to work as political capital through conspicuous ritual deposition in tombs. The execution of certain objects in distinct Minoan technique and style, but depicting mainland-oriented themes such as warfare and hunting, suggests the presence at Mycenae of Cretan artisans.

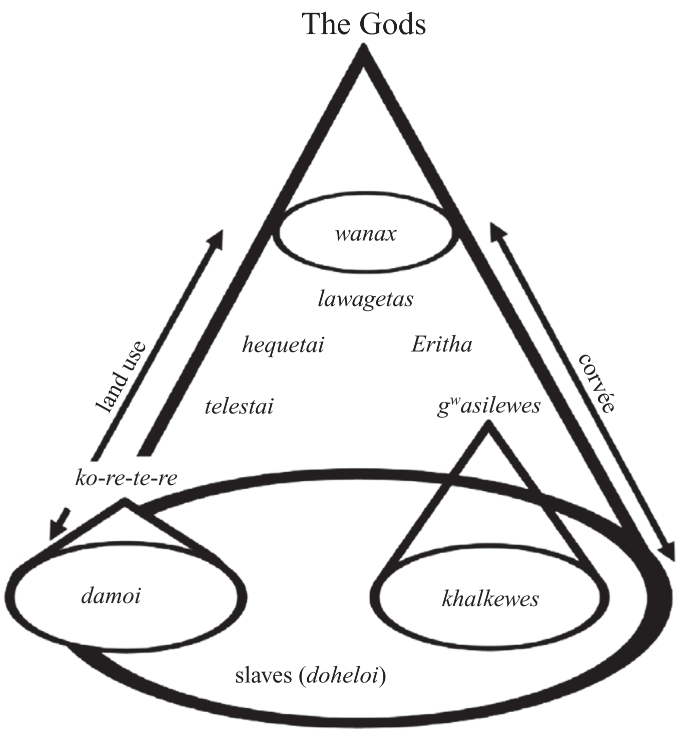
Meanwhile, in Messenia in the southwestern Peloponnese, a competitive process was underway, marked by the occurrence of early tholos tombs at several sites. Regional-scale research has traced the diachronic histories of several small settlements, demonstrating their changing fortunes and functions over time, first within a competitive environment and later as part of a palace state centered at Pylos. Excavations and surface surveys have documented the growth of

2.2 Aerial view of the citadel, Mycenae. Courtesy of Ira Block.

settlement at Pylos from the beginning of the Shaft Grave Era to the formation and expansion of the palace (Bennet 1999), along with an apparent nucleation of population around the palace after 1400 as formerly active settlements in the hinterland diminished in importance (Bennet and Shelmerdine 2001).

The Palatial Period

By 1400 (LH IIIA1 in pottery terms), a handful of palace-based states had emerged on the Greek mainland (Mycenae and Tiryns in the Argolid, Pylos in Messenia, Thebes in Boeotia, and perhaps at Athens, Orchomenos, and elsewhere), apparently because their political elite were able to eliminate rivals in a regional competition for hegemony (Bennet and Davis 1999; Fig. 2.2). These states controlled relatively extensive territories and developed strongly hierarchical political, social, and economic systems (Fig. 2.3), best understood at Pylos thanks to the discovery of an archive of more than 1,100 clay tablets inscribed in Linear B, a syllabic script that represents an archaic form of the Greek language (Chadwick 1994; Ventris and Chadwick 1973; Fig. 2.4). The earliest Linear B archive comes from the palace at Knossos during the period of Mycenaean occupation there. It consists of approximately 4,000 clay tablets from two horizons, the first dating to circa 1400 and the second to the mid-fourteenth century. Most of the remaining tablets are found at the mainland palaces, dating primarily to the destructions at the end of the thirteenth century. In addition to those 1,100 at Pylos, Thebes has yielded around 430, Mycenae 73, Tiryns 24, and Midea 3



2.3 Linear B social pyramid. Courtesy of Dimitri Nakassis.

2.4 Linear B tablet PY Tn 996, recording bathtubs and vessels of gold and bronze. Courtesy of the Department of Classics, University of Cincinnati.

(Bennet 2008: 181). Linear B signs were also painted onto "inscribed" stirrup jars manufactured on Crete and distributed mainly to the palatial sites.

The archive at Pylos contains administrative records of materials entering and exiting the palace; allocations of raw materials to craft workers, of dependent workers and their rations to various projects and industries, and of food and drink for feasts; taxation and land records; conscription of personnel to man fleets; and other transactions (Shelmerdine and Bennet 2008). There are no signs of literary, legal, historical, or liturgical content. The "top-down" perspective of the tablets has encouraged a tendency to portray the Mycenaean palaces as impersonal structures whose managerial control was "pervasive, monolithic and monopolistic" (Bennet 2001: 25), based partly on comparison with obsolete notions of an "Asiatic" palatial economy in the Near East (Cherry and Davis 1999: 94–95). Recently, scholars have reassessed the evidence and increasingly asserted the existence of palatial and nonpalatial sectors of the economy. In reality, these were not entirely separate, non-intersecting realms of activity, but in certain areas of agriculture and craft production the palaces may have shown little interest or exerted little control (Galaty 1999; Halstead 1992a, 1992b, 1999, 2001; Parkinson 1999). Commodities produced from ubiquitous sources, such as pottery and marine products, may have circulated in independent, local markets (Hruby 2006; Knappett 2001; Palaima 1997; Whitelaw 2001a).

The Mycenaean palaces prospered in the fourteenth and thirteenth centuries, corresponding to ceramic phases LH IIIA and LH IIIB. Settlement numbers rose and reached a second-millennium peak in this period. In the northeastern Peloponnese, settlements effectively doubled around the Saronic Gulf (Siennicka 2002: figs. 1, 2), and the palace state at Mycenae pursued an expansive policy by incorporating the Nemea Valley, the Berbati Valley, and the Saronic Gulf region in succession (Schallin 1996; Tartaron 2010; Wright 2004). Although Mycenae was the greatest palace center on the Greek mainland, its scale was modest when compared with contemporary Near Eastern cities (Hope Simpson 1981; Whitelaw 2001b), with a continuously settled area of more than 32 hectares and a population around 6,400, assuming a density of 200 people per hectare (Bennet 2008: 187; French 2002: 64). The extent to which Mycenae dominated the particularly complex political environment of the Argolid remains a matter of some debate: in addition to fortified citadels at Mycenae, Tiryns, and Midea, urban centers flourished at Argos, Lerna, Nauplion, and Asine (Kilian 1988). Although Mycenae was never equaled in wealth and complexity (Voutsaki 2010), so many substantial settlements may indicate political instability with the likelihood of shifting alliances and threats (Voutsaki 1998: 56, 2010: 102–104). The lack of systematic survey of the Argive Plain hampers finer-resolution information on the impact of the interactions among the major centers, as reflected at local scales. Tiryns is assumed to be the main harbor for the Argolid; paleocoastal reconstruction places the shore about one kilometer from Tiryns' walls in the

Late Bronze Age (Zangger 1994a), though as elsewhere no physical traces of harbor facilities remain. In LH IIIB, strong similarities between Mycenae and Tiryns in the architecture of citadel and palace, along with comparable (but not identical) import records (Cline 1994: 89–90), suggest that they worked in concert and not as adversaries (Maran 2003).

In the fourteenth and thirteenth centuries, communication within the Mycenaean world flourished, giving rise to many commonalities in material culture and practice. This so-called koiné is best seen in fineware pottery styles of the LH IIIA and IIIB1 phases (gradually disintegrating in LH IIIB2), close similarities in Linear B scribal language, and a widespread Mycenaean religious ideology represented by ubiquitous anthropomorphic and zoomorphic figures and figurines. Yet the expansion and consolidation of Mycenaean culture was not a uniform phenomenon at any scale. A survey of Mycenaean influence in the different geographical regions adjacent to the Greek mainland, such as the Cycladic and Dodecanese islands, northern Greece, and the northern Aegean islands, shows a variable penetration of Mycenaean culture that does not correlate with simple determinants such as distance or ease of access (Mee 2008: 365–81). For example, during the palatial period, Mycenaean influence in the Cyclades is seen largely in the transformation of pottery styles, while on Rhodes in the more distant Dodecanese islands, Mycenaean pottery, weapons, and jewelry were placed in Mycenaean-style chamber tombs starting in the later fifteenth century. Regional variability is also apparent in the core area, as attested by persistent regionalism in architecture (Darcque 2005) and pottery (Mommsen et al. 2002; Mountjoy 1990, 1999). Similarly, the organization of political and economic life in the Mycenaean heartland existed on a conceptual continuum from direct palatial control to independence from any center. The temporal and geographical expression of these variations was a patchwork in which rates of consolidation of outlying territories varied, and regional and microregional identities were often paramount in the absence of subordination to a palace state (Tartaron 2010).

Decline and Collapse

At the end of LH IIIB2, circa 1200–1190 BC, the Mycenaean palace states collapsed amidst destructions and abandonments at the palaces themselves as well as broadly across the Mycenaean world. The distinctive palatial buildings and fortifications, along with the organization and administration of the state as recorded in the Linear B archives, disappeared forever. There are two important caveats regarding the seemingly sudden and dramatic collapse, however: first, destructions and disruptions began considerably earlier at many sites, revealing a more protracted process of decline leading up to the final collapse; and second, material culture and ways of life that are recognizably Mycenaean did not

vanish, but carried on through a tumultuous time of reconfiguration and change in the twelfth century, before finally fading out by Submycenaean times, circa 1075 BC.

At the end of LH IIIB1, circa 1250, localized destructions by fire occurred at Tiryns' citadel and in the elaborate houses (the Oil Merchant group, the Panayia houses) outside the citadel walls at Mycenae. In Boeotia, an initial destruction affected part of the palace at Thebes, and a more generalized devastation seems to have put the vast fortified site at Gla out of commission. Some of the damage may have been caused by earthquakes, but in many of these cases a violent destruction at human hands cannot be ruled out. There is incontrovertible evidence that in the decades that followed, inhabitants of the palatial centers feared a protracted assault or siege. At Mycenae and Tiryns, the fortification walls were strengthened and expanded to encompass previously undefended portions of the lower slopes, and at Mycenae much of the workshop and storage activity that had been situated outside the walls was relocated inside. New fortification walls were also built at Midea and Athens. Most revealing of the dangerous environment was the construction at Mycenae, Tiryns, and Athens of subterranean passages inside the citadel leading to underground springs outside the walls. Pylos, by contrast, was unfortified in the palatial period, but warnings of impending danger have been read into a set of Linear B tablets recording the mobilization of 800 rowers, with the heading "Thus the watchers are guarding the coasts" (Chadwick 1994: 175). It is not certain whether this recruitment was an emergency measure or a routine annual conscription.

None of these security measures prevented the final destructions of the palaces or the collapse of the palatial system that accompanied them, by circa 1190 BC. Nonpalatial centers, both large and small, were also destroyed or abandoned. The twelfth century was one of considerable upheaval, a complex patchwork of migration, depopulation, and refugee settlement on the mainland (Middleton 2010: 71–92). Entire regions such as Messenia and Laconia were largely depopulated; estimates of the overall decrease in population in the Mycenaean heartland range as high as 75% for the period 1200–1000 (Tandy 1997: 20; but Dickinson 2006: 93–98 doubts this figure). Other settlements and regions became centers for resettlement of refugees. The mountains of Arcadia may have absorbed some of the population fleeing the troubles in Messenia, while at Tiryns the population actually swelled as the Upper and Lower Citadels were reoccupied and the Lower Town expanded, perhaps with refugees from destroyed or abandoned towns of the Argolid (Maran 2001). Much of the settlement within the walls of Mycenae was rebuilt and occupied at a diminished level throughout the twelfth century. Meanwhile, areas on the edges of the former Mycenaean world with good access to the sea prospered in the postpalatial period: the Ionian Islands, the coastal northwestern Peloponnese, the east coast of Attica, and certain of the Aegean islands flourished, perhaps energized by

immigration. Some refugees migrated out of the Aegean entirely, finding their way particularly to Cyprus and the Levantine coast (Yasur-Landau 2010). Even on the devastated mainland, the chaotic early decades of the twelfth century gave way to a modicum of stability – a final "twilight" of the Aegean Bronze Age – in the second half of the twelfth century, corresponding to the ceramic phase designated LH IIIC Middle (Thomatos 2006).

For more than a century, scholars have sought explanations for the rapid and permanent collapse of the palace states, giving rise to a range of hypotheses of varying plausibility (helpfully summarized in Deger-Jalkotzy 2008; Dickinson 2006: 41–57; Drews 1993; Middleton 2010; Schofield 2007: 174–82). Each focuses on a single cause or related set of causes deemed to have been a significant trigger setting into motion the process of collapse. Although a detailed examination of these hypotheses is beyond the scope of this historical summary, the main categories of explanation can be mentioned: (1) external invasions by "Dorian" descendants of Herakles in the generations after the Trojan War (Herodotus 1.56–57; Thucydides 1.12), or the marauding "Sea Peoples" mentioned in the Egyptian records of Merneptah and Ramesses III in the late thirteenth and twelfth centuries BC; (2) internal disturbances including internecine warfare among the palace states or social unrest within a palace state; (3) natural disasters such as droughts or earthquakes, whose effects were sufficiently widespread to precipitate a palatial collapse in a short period of time; and (4) inherent economic/political instability that caused the palaces to collapse of their own weight.

No single explanation has been found satisfactory to account for the widespread and roughly synchronous demise of the palaces. We will probably never know which factors caused the decline and fall of each of the palace states, but we can be sure that no single cause can account for the process. A multicausal approach recognizes that the Mycenaean kingdoms were not optimized for "sustainability," as we would term it today, suffering from inherent organizational weaknesses, notably overspecialization and overcentralization, which made the state susceptible to internal and external threats. Earthquakes, droughts, diseases, and disruptions in trade may have exacerbated social stresses in a strongly hierarchical society, but the combination of factors will have been different in each case, and the cause and effect relationships among primary and secondary triggers will remain speculative. It is important to bear in mind that the collapse of complex society in the Aegean involved mainly the dismantling of an elite superstructure, leaving behind a considerably less complex agropastoral society that was still culturally Mycenaean.

Long-distance exchange in raw materials and exotic finished goods is central to the story of both prosperity and collapse. Mycenaean palatial elites relied on imports for the purposes of self-definition via conspicuous consumption and display, and to ensure the loyalty of potentially adversarial factions among

the aristocratic elements of society (Bennet 2008; Sherratt 2001). In the fourteenth and early thirteenth centuries, the Mycenaeans participated in an eastern Mediterranean world increasingly interconnected by maritime networks; as archaeological, archaeometric, and textual data show, goods flowed relatively efficiently, promoting general prosperity. There is some evidence, however, that in the second half of the thirteenth century, maritime trade routes to the palaces were disrupted, possibly a repercussion of the unstable political climate in the eastern Mediterranean. There is a marked reduction in the amount of Mycenaean pottery exported to the east in LH IIIB2, and imported material at Mycenaean sites seems to decrease at the same time, though the quantities of imports are too small for statistical validity or to form definitive patterns. At Pylos, several Linear B tablets detailing the careful rationing of bronze to as many as 400 smiths in the kingdom have been interpreted to reflect a shortage of metal circa 1200 (Chadwick 1994: 140–41). Such a shortage is possibly corroborated by the presence mainly of scrap metal in the Gelidonya shipwreck and absence of metal in the Point Iria wreck, both dated to around 1200, in contrast to the abundance of copper and tin in the Uluburun wreck a century earlier, but other explanations for this difference are possible (see below). Some of the trouble may have come at the hands of pirates and coastal raiders, the sort of seaborne marauders that later coalesced in Egyptian narratives as the Sea Peoples. It could also be the case that the Mycenaeans, always marginal actors in the east, were cut out of long-distance trade routes and rendered irrelevant as Near Eastern polities had more important concerns close to home (Sherratt 2001: 222–24, 237). A strong orientation to the sea survived the collapse, however: in the twelfth century, many prosperous settlements were situated near the coast and maritime trade was apparently just as important as it had been in the palatial period (Dickinson 2006: 69).

Mycenaean Long-Distance Maritime Activity

As outlined in Chapter 1, research on Mycenaean maritime activity has focused almost exclusively on long-distance trade. The following discussion characterizes the variable patterns of long-distance maritime connections with different areas of the eastern and central Mediterranean over time, before moving to a consideration of the nature of this activity at scales from local to interregional.

The Geography and Chronology of Mycenaean Maritime Activity

As mentioned above, complex society on the Greek mainland emerged with much influence from Minoan Crete in the seventeenth to sixteenth centuries, corresponding to ceramic phases MH III–LH IIA. Minoan dominance of sea lanes in the Aegean and long-distance connections with the eastern Mediterranean

would endure for some time afterward, until widespread destructions on Crete at the end of LM IB brought the neopalatial period to a close around the middle of the fifteenth century. Those destructions left Knossos the only functioning palace on Crete, apparently controlled by a Mycenaean elite who recorded in Linear B the administration of the palace and a broad swath of western to east-central Crete. The Mycenaean presence at Knossos was accompanied by the introduction across Crete of mainland styles of pottery, fresco iconography, and burial practice. The influx of people and material culture from the mainland may have been the result of an invasion that caused the destructions around the island; alternatively a group of Mycenaeans may have exploited an internal crisis to seize control.

On the mainland, the later fifteenth century was still a time of competition and consolidation of regional political hegemony, in advance of the establishment of territorial palace states in the early fourteenth century (LH IIIA1). The mainland polities were not particularly active in maritime ventures in the Aegean or eastern Mediterranean in LH I–II (Mee 2008: 381), most likely because of Minoan control of sea routes. Starting in LH IIIA, the Mycenaeans broadened their overseas contacts into the Aegean and beyond, superseding Cretan interests and inheriting Minoan maritime trade routes to the east. At Miletos on the coast of Asia Minor, a Minoan colony (Miletos IV) was replaced by a Mycenaean colony (Miletos V) encompassing ceramic phases LH IIIA1–IIIA2, roughly 100 years between the late fifteenth and fourteenth centuries, before suffering a major destruction. Mycenaean Miletos is surely to be identified with *Millawanda*, the coastal base of the *Ahhiyawa* in the Hittite texts (Niemeier 2003: 103–105).

In general, Mycenaean objects (mainly painted pottery) begin to appear in quantity in the Aegean, Cyprus, the Levant, and Egypt by LH IIIA1 or LH IIIA2. In LH IIIA and early LH IIIB, most of these Mycenaean vessels were exported from the Greek mainland; a good percentage can be traced to production centers in the Argolid by chemical characterization of their fabrics (Mommsen et al. 2002; Zuckerman et al. 2010). Subsequently, there is a shift in LH IIIB2–IIIC toward local production of Mycenaean-style pottery, and where a Greek provenience can be established, a greater diversity of production centers is indicated. Interestingly, imports to the Aegean from the Near East and Egypt are still heavily biased toward Crete, particularly Kommos and Knossos, in LH/LM IIIA (Cline 1994: 92, 2007). This may be a good illustration of the tenacity of economic relations in spite of political changes and other disruptions (Horden and Purcell 2000: 343–44). A long series of coarse to medium-coarse transport stirrup jars was produced on Crete from the fifteenth to twelfth centuries and used from Sardinia in the west to Egypt and the Levant in the east, including at Mycenaean palace centers in the Argolid and Boeotia (Ben-Shlomo et al. 2011; Haskell et al. 2011; Maran 2005). In LH IIIB, most imports to the Aegean found

their way to the mainland, primarily to a few palatial centers (Mycenae, Tiryns, and Thebes).

An entirely different picture emerges for Mycenaean activity in the central Mediterranean (Blake 2008; Mee 2008: 379–81). Already in LH I Mycenaean pottery appears in southern Italy, Sicily, and the Aeolian islands. In these areas Minoan influence is minimal, and the Mycenaean presence may reflect a freedom to search for alternative sources of raw materials, probably metals. During LH IIIA these contacts expanded; many more sites in Italy have Mycenaean pottery. By LH IIIB, however, contacts diminished sharply with Sicily and the Aeolian islands, while relations with Sardinia and southern Italy strengthened. In the central Mediterranean, Mycenaean pottery was exclusively imported in LH I–IIIA, but in LH IIIB local imitations became increasingly common and by LH IIIC they were predominant. Italian imports in the Aegean are rare, with one exception: at Kommos, which through LH IIIA had been a major importer of goods from the east, objects from the central Mediterranean began to arrive in LH IIIA and by LH IIIB dominated the foreign assemblage (Cline 1994: 90, table 58). Kommos is the closest thing we know of to an international emporion in the Aegean (Rutter 1999; Shaw 2004).

In the postpalatial world of the twelfth century, maritime interaction continued and even prospered, but with significant changes in scale and content (Dickinson 2006: 197–205). The well-organized and regulated system of diplomatic and commercial exchanges in the Near East disappeared, and this had consequences for the Aegean as well. The large, standardized cargoes of metal ingots and goods shipped in large transport containers, referred to in Near Eastern and Egyptian texts and demonstrated so spectacularly in the Uluburun shipwreck, no longer made their way to the Aegean. Very few transport stirrup jars or Mycenaean fineware vessels left the Aegean. Yet Near Eastern ships continued to voyage west in search of metals. Along the way, they stopped on Attica's eastern coast at Perati, where the community probably controlled the silver mines at Lavrion. Further north, Lefkandi and Mitrou may have been stops on the route to metal sources on the Chalkidiki peninsula. Elsewhere, good harbors on Crete and the Greek mainland offered stopping points en route to the metal sources of Sardinia and Italy.

On the whole, maritime connections were as important in LH IIIC as in the palatial period, particularly with potentially dangerous conditions in the interior, but the scope of the exchanges was modified. Some exotic goods from distant places still reached the coastal settlements of the Aegean, but these were mostly small items that we might be tempted to characterize as trinkets. In the LH IIIC Middle chamber tomb cemetery at Perati, the grave goods include Egyptian, Syrian, Mesopotamian, and Cypriot seals, scarabs, amulets, and beads (Thomatos 2006). The scarcity of Aegean-made transport stirrup jars and other fineware vessels outside the Aegean suggests that perfumed oils, wine, and

probably textiles were no longer manufactured for export. There is a perceived shift toward regional and local exchange networks in a less regulated and more opportunistic environment. Vigorous trade continued within the Aegean orbit, as attested by the movement of pottery and the mutual influences of local styles. Regions such as the Euboean Gulf preserved their strong maritime orientation and took on distinct identities characteristic of maritime small worlds (Crielaard 2006). But the interregional contacts that did survive were of great importance, particularly for the introduction of new metal styles and technologies. The technology of ironworking seems to have been developed on Cyprus and was learned there by Greek immigrants in the postpalatial period (Iacovou 2006, 2008a, 2008b; Pickles and Peltenburg 1998), and recently introduced metal artifact types arrived from northern Italy, including long pins, fibulae, Naue Type II swords, daggers, and "flame"-shaped spearheads (Dickinson 2006: 204). Cyprus seems to have been of capital importance in this era, pursuing an independent agenda with active ties in the Levant, in the central Mediterranean with Sardinia, and on the Greek mainland with Euboea, Attica, and Tiryns (Maran 2004). The notion of a sharp swing from maritime exchange dominated by interregional networks to a narrowed focus on local and intra-Aegean relations is misleading, for two reasons. First, ongoing discoveries have shown that long-distance ties were not cut as completely as once thought. Second, as argued in Chapter 1, local- and regional-scale networks must always have dominated the total picture of maritime interactions. The thriving interregional relations of the fourteenth and thirteenth centuries were more the product of exceptional circumstances; being so extraordinary, they draw attention away from other scales of interaction.

The Frequency and Volume of Interregional Trade

There are different ways of interpreting the thousands of Aegean Bronze Age objects, predominantly pottery, which have been recovered around the eastern and central Mediterranean (Cline 1994; Lambrou-Phillipson 1990; Leonard 1994; van Wijngaarden 2002). Looking at the same evidence, one person can find the wide contacts and varied contexts impressive and view the pottery as the tip of an iceberg of perishable items such as textiles and foodstuffs that must have moved along with the durable ceramics. A second person would emphasize the very small quantities that are attested from the perspective of time and space, perhaps even running a simple quantitative analysis to determine that the corpus amounts to 0.5 objects imported to the Aegean from the eastern Mediterranean per year over six centuries (Cherry 2009: 111–12), or using a more sophisticated approach, fewer than ten contacts per decade (Parkinson 2010: 16–25). As always, the truth must lie somewhere in the middle, but it is difficult to know where in the absence of so much key evidence.

The Linear B tablets are of little help. They contain rare allusions to the palaces' external relations, but none explicitly mentions merchants or long-distance maritime exchange. Exchanges of some kind are implicit in the recording of certain exotic commodities like sesame and ivory, and slave women hailing from the coast of Asia Minor who may have arrived at Pylos as war booty (summarized by Cline 2007: 198–99). We also learn from the Pylian tablets that the palace built and manned ships in the service of the state (Palaima 1991). A few instances of regional interaction are recorded: a tablet at Mycenae mentions a transaction with Thebes (Cline 1994: 128–31; Killen 1985: 268; Chadwick 1994: 80–81), and another at Thebes documents exchanges with towns on Euboea (Aravantinos et al. 2001).

From one perspective, the implication that one might infer from the Linear B archives that interregional exchange was an insignificant sector of the Mycenaean economy does not square well with the emerging archaeological record from around the Mediterranean. Durable Mycenaean imports, chiefly fine pottery and bronze weapons and implements, continue to be found in modest amounts in the eastern and central Mediterranean; under these circumstances, it is puzzling that so few "Orientalia" and "Occidentalia" are turning up in Aegean contexts (Cline 2009: 167–68).

The apparent contradiction between the textual and archaeological evidence has engendered a divergence of opinion regarding the scale of Late Bronze Age trade in the Mediterranean, with opposing camps that may be labeled "minimalist" and "maximalist." (For an analysis of the roots of this debate in economic anthropology, see Tartaron 2001a.) Among the minimalists, Anthony Snodgrass is most prominent in denying a significant role for commercial trade in the Bronze Age economy, maintaining that a redistributive center would only send its ships abroad ". . . when it needs resources from overseas, and this may be very infrequently" (Snodgrass 1991: 18). For the minimalists, the archaeological record is meager evidence (Manning and Hulin 2005), best explained in terms of infrequent, directional elite gift exchange that has nothing to do with money, markets, or private enterprise. Independent merchants have little place in this tightly regulated maritime economy (Chadwick 1994: 156–58).

The maximalist school tends to view Bronze Age trade as extensive, driven by market forces, and involving a substantial contribution from private merchants. Eric Cline (2009: 163–64) has recently restated his position on trade between the Aegean and eastern Mediterranean: (1) Trade was mainly directional to the major palace centers of the Aegean, with secondary redistribution from those centers; (2) Trade was predominantly commercial, with some gift exchanges occurring at the diplomatic level; (3) The primary traded goods were wines, perfumes, oils, and metals; (4) Crete was the main recipient of imported goods from the eastern Mediterranean in the seventeenth to fourteenth centuries (LH/LM I–IIIA);

(5) The Greek mainland was the main recipient of imported goods from the eastern Mediterranean in the thirteenth to mid-eleventh centuries (LH/LM IIIB–IIIC); (6) Crete interacted mainly with the East in LH/LM I–IIIA, and primarily with the West in LH/LM IIIB–IIIC; (7) The Greek mainland interacted with the West, and to a lesser extent, the East in LH/LM I–IIIA, and with the East in LH/LM IIIB–IIIC; (8) Egypt monopolized trade with the Aegean during LH/LM I–II, and shared the Aegean trade with Syro-Palestine, Cyprus, and Italy during LH/LM IIIA–IIIC. Cline (1994: 106, 2009: 164) has also reiterated his opinion that the scale of trade encompassing Egypt, the Near East, Italy, and the Aegean in the Late Bronze Age rivals that of today in economic complexity and political motivation. Sherratt and Sherratt (1991: 376) concur that the Bronze Age economy was a market economy in the formal sense.

The evidence of shipwrecks points unmistakably to a large, but archaeologically invisible, trade in raw materials and organic substances that do not normally survive in the archaeological record (Bass 1997). The Bronze Age shipwrecks excavated by George Bass and Cemal Pulak on Turkey's southern coast at Cape Gelidonya and Uluburun (see below for details) provide a glimpse of the breadth and cosmopolitan origin of material being transported around the Mediterranean (Bass 1991, 2005b; Pulak 1997, 1998, 2005). The main cargo of the Uluburun wreck comprised 10 tons of copper ingots, 1 ton of tin ingots, 175 glass ingots, a ton of terebinth resin stored in 130 of 145 Canaanite jars, and large amounts of varied Cypriot pottery. Also included were rare and exotic materials such as ebony logs, raw hippopotamus and elephant ivory, finished ivory objects, ostrich eggshells, seals, an Egyptian scarab bearing the name of Nefertiti, and vessels of faience, gold, and tin. A few swords and utilitarian objects such as knives, razors, chisels, oil lamps, and fishing equipment belonged to the crew. Numerous sets of pan-balance weights in the Near Eastern standard attest to the presence of a Semitic (not Aegean) merchant or merchants among the crew. Thanks to careful recovery methods and subsequent analyses, specialists were able to identify a range of organic remains including grains, nuts, spices, olives, figs, and pomegranates, as well as various branches and rushes used as dunnage in packing the main cargo (Knapp 1991; Haldane 1993). A dozen cultural groups – Canaanite, Egyptian, Cypriot, Mycenaean, Assyrian, Babylonian, Kassite, Nubian, Baltic, Balkan, eastern Near East, and possibly Sicilian – are represented in the raw and finished materials (Pulak 1997: 256). With the exception of the pottery, most of the material from the Uluburun wreck would rarely survive in a terrestrial archaeological context: the organic material would have long since disappeared, and most ingots would have been melted down or otherwise rendered unrecognizable in antiquity. The remains preserved on the Uluburun wreck permit us to imagine the range of goods conveyed around the eastern Mediterranean at the time of the Mycenaean palaces.

The excavator suggests that the Uluburun ship originated in a Syro-Canaanite port, and was bound westward toward the Aegean with a probable final destination at one of the Mycenaean palaces, " . . . an official dispatch of an enormously rich and valuable cargo of raw materials and manufactured goods largely intended for a specific destination" (Pulak 1998: 220). As such, it is perhaps not a "microcosm" of international trade in the fourteenth and thirteenth centuries, as has been claimed (Cline 1994: 100; criticized by Burns 2010: 15), but it could be used to buttress Snodgrass' vision of rare, directional gift exchange. Further support might be drawn from Pulak's (1998: 218) interpretation of some of the personal effects as belonging to two Mycenaean Greeks on board, whom he construes as emissaries accompanying the rich cargo to its final destination in the Aegean (see also Bachhuber 2003: 134–46).

The Gelidonya shipwreck represents a different, less elite form of maritime traffic, however. It contained mainly metal ingots along with scrap metal and metalworking tools, and is interpreted by the excavator as a private Levantine merchant vessel with a metal tinker on board, engaged in tramping from port to port (*cabotage*) in search of opportunities to buy, sell, fabricate, and repair metals (Bass 1991: 75). A third LBA shipwreck, which went down at Point Iria in the Argolic Gulf, is highly ambiguous because the small cargo consists only of a mix of Cypriot, Cretan, and Greek mainland pottery (Phelps et al. 1999). The ship may have originated in any of those places, and it may have been plying local networks rather than long-distance routes (see discussion of shipwrecks below). It is also crucial to consider that textual and archaeological evidence from the Bronze Age eastern Mediterranean demonstrates the conflation of private (entrepreneurial) and state-sponsored (palatial) merchant activity (Bachhuber 2006: 355; Knapp 1993; Manning and Hulin 2005: 273; Wiener 1987: 264). Even if the primary function of the Uluburun ship was to implement directional trade from one royal court to another, the diversity of the cargo and the presence of many balance weight sets suggest merchants conducting trade for profit at ports of call at Ugarit and on Cyprus.

A compromise between the minimalist and maximalist positions presents itself in the realization of multipurpose voyages and mixed cargoes, and when the volume of trade is distinguished from its significance. Sherratt and Sherratt (1991: 354) suggest that although the quantities of goods transported over long distances were small relative to total production, their importance should not be underestimated, for they represent the efforts of a minority to acquire goods possessing tremendous social significance. A good case can be made that imported goods arriving in the Aegean from the eastern Mediterranean were imbued with a kind of symbolic power derived from the distances traveled and their mysterious cultural origins (Broodbank 1993; Helms 1988; Knapp 1997). To those who possessed them and controlled their distribution, they imparted esoteric knowledge and prestige, which could be manipulated to legitimize and

maintain real social and political power. Bryan Burns (2010) rightly emphasizes that the true significance of imported goods lies not in their source or any meaning they held in their originating culture, but rather in how they were assimilated into indigenous frameworks of meaning in the destination contexts, and hoarded, displayed, or dispatched to enhance status and influence social action. The seemingly narrow distribution of imports in the Aegean may be the result of a deliberate strategy on the part of elites to control quantities as well as content, because exotic objects lose their power when they are widely distributed.

As might be expected, the cumulative evidence favors neither of the extreme ends of the minimalist/maximalist spectrum. With recent research highlighting limits on the control that palaces could exert geographically and over specific sectors of the economy, it is implausible that all long-distance maritime activity was state sponsored or that there was no scope for merchants to pursue private profit. Nevertheless, the concentration of exotic imported goods at palatial centers on Crete and the mainland is a powerful indicator that elites at these centers actively sought to monopolize access to certain valued products. They were successful at doing so because they uniquely possessed sufficient capital and political authority to acquire and transport high-value commodities over long distances (Bennet 2008: 191). Their interest lay mainly in precious metals and other exotic materials that conferred both symbolic prestige (jewelry, vessels in precious metals, ivory plaques and inlays, etc.) and practical advantage (weapons, superior tools). Perhaps nonpalatial merchants dealt mainly in subsistence goods and utilitarian pottery and tools, and circulated in regional and local rather than international, cross-cultural networks. The Gelidonya and Point Iria wrecks might be seen in this light.

Direct and Indirect Contact

The notion that Mycenaeans were great seafarers voyaging across the Mediterranean is widely held among scholars who focus on the Greek world, engendered by the broad distribution of Mycenaean artifacts as well as the influence of the Trojan War epics. For an earlier generation of scholars, it was Minoan and then Mycenaean sailors, merchants, and craftsmen who forged the link between the Aegean and the eastern Mediterranean and managed cross-cultural trade between these areas (Kantor 1947). This was partly (over)compensation for prevailing *ex oriente lux* frameworks proclaiming the diffusion of knowledge from the civilized Near East to a barbarian Europe (e.g., Childe 1925). In recent years, the archaeological basis for assigning the Mycenaeans such a prominent role in eastern Mediterranean maritime networks has been deconstructed and reassessed (Bass 1998), and the Homeric epics have been decoupled from a historical Bronze Age context (Bennet 1997; Morris 1997; Raaflaub 2006). Near Eastern

and Egyptian texts, along with the strong Syro-Canaanite character of the Uluburun and Gelidonya shipwrecks, have counteracted the Hellenocentric bias. Yet the pendulum continues to swing back and forth: world-systems theory was exploited initially to characterize the Aegean as a dependent "periphery" to a dominant Near Eastern "core." Subsequently, Nick Kardulias has restored some agency to the Aegean with concepts of "negotiated peripherality" (Kardulias 2007) and "linked maritime exchange cycles" in which Minoans and Mycenaeans participated in eastern Mediterranean trade on relatively equal footing (Kardulias 2009). The applicability of world-systems approaches remains a matter of vigorous debate (papers in Parkinson and Galaty 2009a) and many are not convinced (Burns 2010: 18–19; Cherry 2009; Cline 2009).

Moving beyond theoretical characterizations, the empirical evidence for Mycenaean long-distance voyaging beyond the Aegean is indirect and mostly circumstantial. No Bronze Age boat or part thereof has survived that is unequivocally a Mycenaean vessel. No indisputable evidence exists that Mycenaean ships visited Egypt or the farthest reaches of the Levantine coast, as opposed to trading through Syro-Canaanite or Cypriot middlemen. The case against visits to Egypt involves a qualitative change: after the Minoans were depicted as *Keftiu* bearing gifts to Pharaoh on wall paintings in tombs from the reigns of Hatshepsut (reign circa 1479–1457) to Amenhotep II (reign circa 1427–1400), the Mycenaeans were not depicted in the same way, nor were they mentioned in the Amarna archive at a time when large quantities of Mycenaean fineware pottery reached Akhenaten's capital of Akhetaten (Tell el-Amarna). As noted above, there is a lag of about a century between the Mycenaean occupation of Knossos circa 1450 and the widespread appearance of LH IIIA2 pottery at Amarna and many other sites (Judas 2011). It took even longer – until the end of the fourteenth century – before Egyptian exports to the Aegean found their way to the mainland more abundantly than to Crete.

There is some evidence for direct contact with Egypt, however. The so-called Aegean List inscribed on the back of one of five statue bases at the mortuary temple complex of Amenhotep III (reign circa 1390–1352) is a roster of place names from the Aegean. Following the ethnics *Tanaja* (thought to refer to mainland Greece) and *Keftiu* (the Cretans) are the names Amnisos, Phaistos, Kydonia, Mycenae, Thebes, Kato Zakro, Methana, Messana, Nauplion, Kythera, Ilios (Troy), Knossos, Amnisos again, and Lyktos. The list has been interpreted as the itinerary of a royal diplomatic mission, perhaps to reaffirm relations with old Minoan trading partners and to visit the mainland centers during the transition from Minoan to Mycenaean control of sea routes into and out of the Aegean (Cline 2007: 194; Hankey 1981). Cline (2007: 194) even links a number of faience plaques, faience scarabs and seals, and a frit vase, found mainly at Mycenae and all inscribed or painted with the cartouche of Amenhotep III or his wife Tiyi, with this same diplomatic mission. These objects, most of which were

found in later (LH IIIB) contexts, could equally have arrived at various times and in diverse ways. At the very least, however, the Aegean List does show that the Egyptian court was aware of the most important LBA centers on Crete and the mainland. A final bit of intriguing evidence comes from Amarna. A papyrus fragment dated roughly to the mid-fourteenth century by an associated LH IIIA2 stirrup jar bears a painted scene in which a group of Mycenaean-looking soldiers rush to the aid of a fallen Egyptian (Schofield and Parkinson 1994). If this scene reflects a real state of affairs, it suggests the presence of Mycenaean mercenaries in Egypt. According to one recent hypothesis, the imported Mycenaean stirrup jars at Amarna, shown to have been manufactured in the Argolid, held olive oil presented to Akhenaten's royal court as part of a diplomatic exchange, the first of many such exchanges that led to the widespread cultivation of the olive in Egypt (Kelder 2009).

Many favor the Cypriots as the principal intermediaries between Mycenaean Greece and the Near East in the fourteenth and thirteenth centuries (e.g., Bell 2005: 368; Hankey 1967; Mee 2008: 377; Sherratt 2009: 97–98). There are solid arguments for this position. Cypriot pottery is distributed alongside Mycenaean fineware at Levantine sites like Ugarit, Sarepta, and Tell Abu Hawam, but in greater quantities. The amount of Mycenaean pottery at Cypriot sites like Enkomi is considerably greater than is found at the Levantine sites, but the vessel types are quite similar. Significantly, Cyprus had a history of relations with the Aegean, adopting Cypro-Minoan script and importing pictorial kraters and amphoras specially made in the Argolid for the Cypriot and Syro-Canaanite market. Susan Sherratt (2009: 97–98) proposes that in the thirteenth and twelfth centuries, it was Cypriot small-scale commercial traders who linked the central and eastern Mediterranean in an unprecedentedly direct way, bringing Sardinia and the head of the Adriatic into contact with the eastern Mediterranean. According to Sherratt, the Cypriots not only distributed Mycenaean pottery in the eastern Mediterranean, they came to the Aegean to get it, visiting other Aegean ports of call such as Kommos regularly (Rutter 1999). Against Sherratt's notion is the fact that while Mycenaean pottery imports in Cyprus peaked in LH IIIA, Cypriot exports to the Greek mainland did not become substantial before LH IIIB (Cline 2007: 196).

Until a few years ago, the Mycenaeans were absent in Canaanite archives, but now scholars have identified two letters of the late thirteenth or early twelfth century at Ugarit that appear to give the Akkadian version of the Hittite name for the Mycenaeans, *Ahhiyawa* (Cline 2009: 178; Lackenbacher and Malbran-Labat 2005: 237–38; Singer 2006: 250–52). It is possible that these documents establish some sort of presence for the Mycenaeans at Ugarit.

Another key text implies that the Mycenaeans may have ventured east beyond Cyprus. In a letter to King Sausgamuwa of Amurru, on the northern Syrian coast, Hittite King Tudhaliya IV (reign circa 1237–1209 BC) instructs

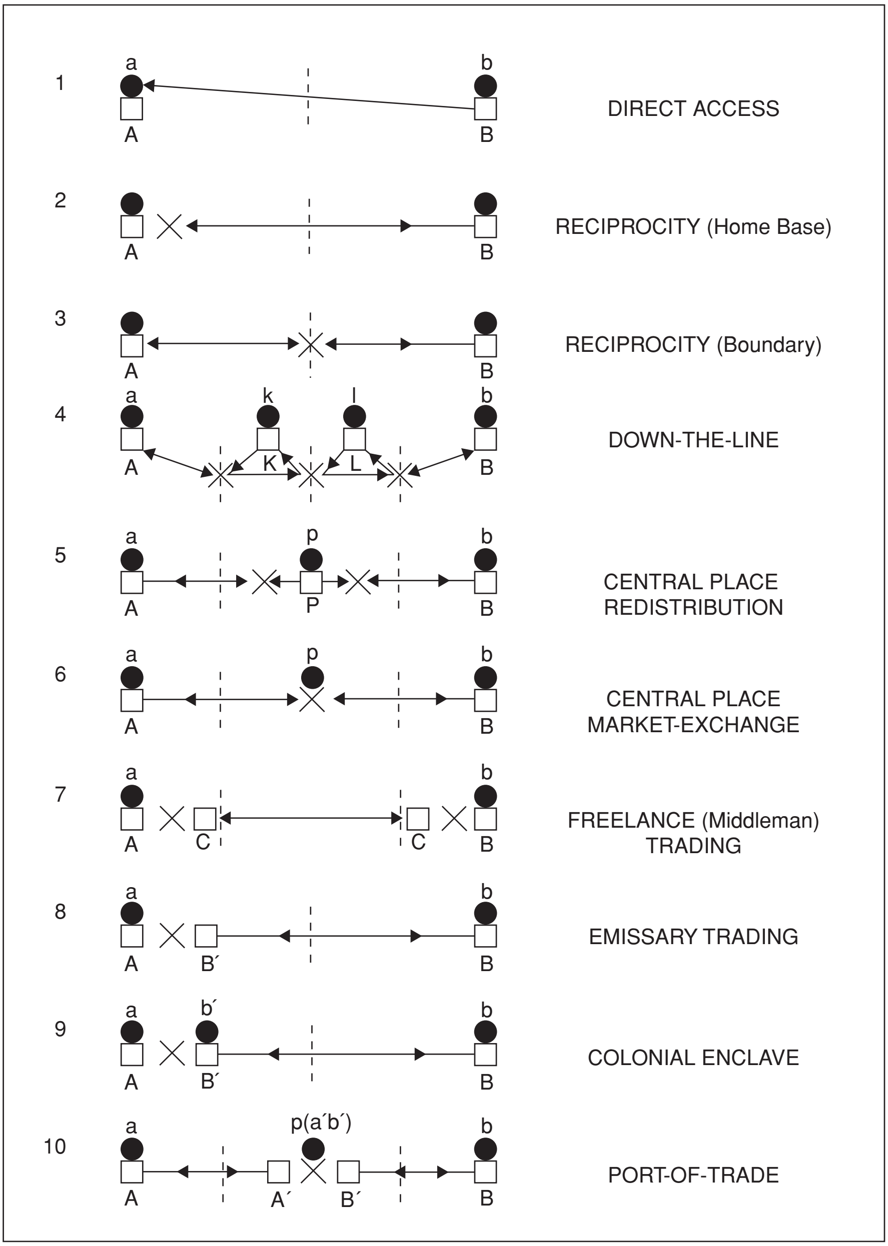
his vassal to prevent the ships of Ahhiyawa from coming into contact with the Assyrians through the ports of Amurru (Cline 1991; Güterbock 1983: 136). The obvious implication is that the ships of Ahhiyawa (i.e., Mycenaeans) had reached these ports in the past.

Cline (2009: 170–73) is steadfast in his opinion that Mycenaean ships were making direct voyages to Egypt and the Levant, although he acknowledges that the evidence is inconclusive. He emphasizes that the Minoans and Mycenaeans did not lack the navigational or organizational skills to make these voyages; thus, the rules of eastern ports or actions like the Hittite embargo may better explain the presence or absence of Mycenaean merchant ships. Often lost in the discussion is the fact that few scholars have expressed doubts that from LH I, Mycenaean ships were sailing to Italy and Sicily. Although maritime routes to the west did not involve a lengthy open-sea voyage similar to that from Crete to Egypt, there were plenty of environmental and navigational challenges along the routes across the Ionian and Adriatic Seas to southern Italy, Sicily, the Aeolian Islands, and eventually Sardinia. An implicit assumption about Mycenaean engagement with the west is that the indigenous inhabitants of the central Mediterranean did not possess the requisite seafaring technology or economic organization to travel east, an impression strengthened by the virtual absence of their finished goods in the Aegean. Whether or not this assumption is correct, the same cannot be said about Minoan or Mycenaean navigational capabilities. It is worth considering instead that the Mycenaeans were able to obtain the commodities they wanted most – Cypriot copper, tin from further east, luxury materials such as ivory – from visiting Eastern ships or by sailing to emporia on Cyprus or the northern Syrian coast, which served as collection points for products from far and wide. In these circumstances, the Mycenaeans may have had little need to make direct voyages to Egypt, which accordingly would have been infrequent.

Mechanisms of Trade

From the evidence outlined above, it becomes apparent that Mycenaean extra-Aegean transactions involved a diversity of settings, participants, and mechanisms of transfer. To get a better sense of the range of trade scenarios, it is worth looking back to a classic treatment of ancient trade in which Colin Renfrew (1975: 41–43) postulated 10 "modes of trade" that specified the participants and the locations where exchanges took place (Fig. 2.5).[1] Renfrew's modes are as follows, with comments added:

(1) Direct access: *B* has direct access to a resource found at *a* without the involvement of *A*, and without concern for territorial boundaries; there is no actual exchange transaction. The clearest example in Aegean



2.5 Renfrew's modes of exchange. Renfrew 1975: 42, fig. 10. Courtesy of Colin Renfrew.

prehistory is the assertion that in the Early Bronze Age (EBA), obsidian was obtained directly from Melos without the mediation of the Melians (Renfrew et al. 1965; Torrence 1984).

(2) Home-base reciprocity: *B* visits *A* at *A*'s home base, exchanging product *b* for product *a*. These are direct, face-to-face exchanges that are

most characteristic of local interaction networks, but could also apply to longer, regional- or interregional-scale interactions involving, for example, a Cypriot ship sailing to Tiryns to drop off a shipment of copper ingots in exchange for pictorial pottery and textiles.

(3) Boundary reciprocity: *A* and *B* meet at a common boundary to exchange goods. It is often difficult to establish the locations of Bronze Age political boundaries, but one could imagine such trade occurring at frontier zones between Mycenaean polities, between Mycenaean and partly Mycenaeanized zones (e.g., the Bay of Volos with interior Thessaly), or at the outskirts of Miletos. The connotation of neutrality inherent in boundary reciprocity gives these spaces the quality of quasi-emporia or quasi-"ports of trade" as envisioned by Karl Polanyi (1963).

(4) Down-the-line trade: commodities travel across successive territories in a series of home-base or boundary reciprocity exchanges. In this case, goods move step by step through exchanges between agents departing from their home bases. A good example would be a shipment of Mycenaean pottery from the Argolid conveyed by sea to Enkomi on Cyprus; from there, a load is taken to Ugarit or Tell Abu Hawam along with other goods, and some of these vessels are subsequently transported along overland routes to Canaanite and Mesopotamian sites in the interior.

(5) Central-place redistribution: *A* takes produce to *p*, rendering it to *P* and receiving something in return; *B* takes produce to *p* and receives from *P* some of *A*'s produce. This is one of Polanyi's classic "forms of integration" by which "primitive" economies were organized (Polanyi 1957; Sahlins 1965). Mycenaean palaces were often cast as centers of redistribution, but the ambiguity of the concept and the implication of a center's altruism in reallocating resources based on others' needs has led many to advocate the use of alternative concepts such as mobilization, in which goods and services are mobilized upward to the palatial center, and there used primarily to support palatial projects and to enhance the wealth and power of the elite (Bennet 2008: 190; Earle 2011; Halstead 2011).

(6) Central-place market exchange: *A* takes produce to *p* and exchanges it there with *B* for *B*'s produce. *P* is not directly involved in the exchange. This mode best describes open market towns, or periodic market days hosted by a particular town. These surely existed in the Bronze Age Aegean, as they have virtually everywhere where there is historical evidence. We might imagine fish, pottery, and other everyday items circulating in such markets outside of palatial oversight in the kingdom of Pylos, for example, but they have not been identified on the ground.

(7) Freelance (middleman) trading: Middleman *C* exchanges with *A* at *a*, and with *B* at *b*. *C* is not controlled by *A* or *B*. This form of trade is often referred to as *cabotage* or *tramping*, and differs from down-the-line

trade in that the merchant or middleman operates independently of the sellers and buyers of the commodities he takes on or discharges en route. Renfrew (1975: 44) remarks that freelance trading is more efficient than down-the-line trade, since it reduces the number of trips and thus a good deal of effort. The Gelidonya shipwreck is often seen as a tramping vessel carrying a metal tinker and roaming from port to port.

(8) Emissary trading: *B* sends emissary *B′*, an agent under his jurisdiction, to *a* to exchange goods with *A*. The Uluburun shipwreck, possibly with Mycenaean emissaries aboard and seemingly headed toward the Aegean with a return cargo destined for a Mycenaean palace, fits this profile.

(9) Colonial enclave: *B* sends emissaries *B′* to establish enclave *b′* in the vicinity of *a* in order to exchange with *A*. The most famous example from the Bronze Age is the Assyrian trading colony or *karum* installed at Kanesh in southeastern Anatolia from circa 1920–1835 BC (Veenhof 1997). An enclave of several thousand Assyrian merchants lived in the lower town, and their commercial transactions with their Anatolian hosts are recorded in roughly 20,000 cuneiform tablets from at least 70 distinct archives. Their trading agenda was relatively specific: Afghan tin and Babylonian woolen textiles were imported from Assur; in exchange, huge quantities of silver and lesser amounts of gold were exported to Assur (Veenhof 1997: 338–39).

(10) Port of trade: Both *A* and *B* send emissaries *A′* and *B′* to a central place (port of trade) that is outside of the jurisdiction of either. Polanyi (1963) envisioned the port of trade as a universal type: a place and a mechanism for the safe transfer of goods in a cross-cultural setting. Polanyi's model differs from Renfrew's definition in that the host society might exercise jurisdiction over the port of trade and participate in the business transacted there. The notion of a neutral space was integral to Polanyi's conception because of the potential threat posed by the indigenous and foreign communities to one another. An emporion such as Ugarit on Syria's Mediterranean coast fulfilled this role for a range of trading partners in the eastern Mediterranean; it may be significant that the settlement of Ugarit/Ras Shamra was separated by a kilometer from the port town (port of trade) at Minet el-Beidha.

Sources of Evidence and Source Criticism

In the concluding section of this chapter, I briefly summarize the sources of evidence for Mycenaean maritime activity, highlighting the strengths, weaknesses, and potential of each category. The main categories are

(1) Archaeological: The spatial, chronological, and typological distribution of objects of Mycenaean origin found outside the Mycenaean world, and foreign objects found at Mycenaean sites;

(2) Textual: Linear B archives from the Mycenaean palaces bearing on maritime matters, and references to Mycenaeans in Anatolian, Egyptian, or Near Eastern archives;
(3) Iconographic: Artistic representations of Aegean persons or activities found in non-Aegean contexts, and representations of ships and seafaring activities in Aegean contexts;
(4) Shipwrecks: A handful of LBA shipwreck deposits recovered in Greek and eastern Mediterranean waters;
(5) Environmental: Harbor sites and evidence for changing coastal landscapes, as well as data on weather, winds, and currents;
(6) Ethnographic: Analogies based on information drawn from historical, recent, and living societies.

Archaeological Evidence

The distribution in time and space of the Mycenaean goods exported from the Aegean and the foreign imports into the Aegean has been well documented in catalogues by Cline (1994) and others (Judas 2011; Lambrou-Phillipson 1990; Leonard 1994; Phillips 2008; van Wijngaarden 2002), and the corpus has been subjected to extensive comment and interpretation. As Cline (2009: 164–65) notes, the corpus is not growing very rapidly, and it has inevitable limitations. Yet there are undeniable patterns in the data that enable us to ask informed questions about the dynamics of cross-cultural networks of interaction. Some of these questions can be illuminated using archaeometric characterization studies, such as petrographic and chemical analyses of ceramic fabrics to address sourcing as well as technological styles and traditions. We can only speculate on the magnitude of the perishable, mainly organic, material that moved through these networks, as well as the metals that were destroyed, recycled, and otherwise removed from the Bronze Age archaeological record. But judging from the textual records recovered in the Aegean, Egypt, and the Near East, the circulation of perishable material must have been immense. We are left with a database that is meaningful and amenable to interpretation, but the small quantities of material and the frequent ambiguities as to the precise dates of objects and their find contexts create challenging problems for quantitative analysis and other measures of significance. Regardless of how the data are analyzed quantitatively, the inevitable conclusion will be that " . . . long-distance exchange with the Aegean was infrequent, sporadic, and consisted primarily of the importation of small prestige items" (Parkinson 2010: 17–18). Just how to factor in materials that do not survive, and whether these would significantly change the picture, are thorny questions. Furthermore, recovering the exchange events and mechanisms by which the material was transported from its production source to the consumer (and any subsequent transfers in an object's "life history") may be impossible in an environment of webs of interaction where down-the-line trade,

cabotage, and other complex modes of exchange overlap. The stability of categories of use and meaning of an object between the originating and consuming cultures is a further complication, though sometimes its contextual associations are revealing. Changes in practice (e.g., burial or cult practices) can indicate the transmission of intangible ideas where archaeological evidence for meaningful contact is otherwise lacking.

Exchange from region to region within the Aegean world can often be identified by the movement of artifacts with distinctive form, style, or manufacturing tradition. The more local the exchanges become, the less likely that there will be detectable differences in material culture, but if a center of production for a distinctive product is known, for example the volcanic rock-tempered storage and cooking wares of Kolonna on Aigina, movements at very close range can be discerned (see the detailed case study on the Saronic Gulf in Chapter 7).

Textual Evidence

Contemporary textual references to Mycenaean maritime activity or to the interactions of Mycenaeans with people and places beyond the Aegean are few. They include sporadic references in the Linear B archives, and a small number of mentions of Mycenaeans in Egyptian, Hittite, and Canaanite texts (Bennet 2008: 181; Cline 2009: 175–79).

There are several possible explanations for the near silence of the Linear B archives on exchange within the Mycenaean world and without. One has to do with the narrow temporal scope of the documents, because the tablets were meant as temporary records and so only those referring to current or very recent activities were preserved. Based on the seasonality of the activities and plants mentioned and not mentioned in the Pylian tablets, it is believed that the destruction of the palace occurred in spring and that the activities recorded therein do not extend back further than six months or so (Chadwick 1994: 191–92). If that is the case, we might imagine that most maritime activity involving palatial oversight would have been in hiatus over the winter. Shipbuilding (Pylos tablets Vn 46 and Vn 879), however, would be ongoing in preparation for the return of major maritime endeavors in the spring. A second explanation is that the palaces did not control maritime trade and thus would not be expected to record an activity outside of palatial purview. It is hard to believe, however, given the attention to building and manning ships, and the priority placed on acquiring and controlling access to raw and exotic materials that could only have arrived by sea, that there would be no meaningful palatial involvement in maritime matters. A third possibility, mentioned already, is that there was an interruption of maritime trade toward the end of the thirteenth century, cutting off seaborne imports. The disturbances that led several palaces to enhance their fortifications and excavate access tunnels to external subterranean springs

may also have severed overland communications. Despite these hypothetical disruptions, the Linear B archive at Pylos seems to record normal palatial activity, including feasts and sacrifices, maintenance of palatial industries with their dependent workers, and collection of agricultural goods that seem not to be in short supply.

Mycenaean Greece appears in Egyptian texts as *Tanaja*, and in Hittite and Canaanite texts as *Ahhiyawa* and related terms (Cline 2009: 178). The Aegean List from Kom el-Hetan ensures that the Egyptians were aware of the Mycenaean palatial centers, and the combination of copious Mycenaean fineware and the painted papyrus depicting Mycenaean soldiers at Amarna helps to counterbalance the absence of mention in the Amarna archive. The Mycenaean Greeks are sometimes counted among the *Ekwesh* (= Ahhiyawa?) listed in the Merneptah Stele commemorating the victory of Merneptah (reign circa 1213–1203) over a combined force of Libyans and mercenaries from the northern seas, and they may have formed part of the loosely organized marauders that Ramesses III repulsed circa 1176 BC, according to the Medinet Habu inscription. The recently identified references to Mycenaeans in the archive at Ugarit add support to the contention that Mycenaeans did voyage beyond Cyprus to Levantine shores.

More extensive than these, however, are a number of Hittite documents that have real historical significance. Presuming that Ahhiyawa refers to a Mycenaean kingdom to the west of the Anatolian coast – and there is plenty of debate on whether that center was located at Mycenae, Thebes, Rhodes, or elsewhere – it is possible to follow the Mycenaeans causing mischief in the western provinces of the Hittite Empire in the fourteenth and thirteenth centuries from their coastal base at Millawanda (Miletos; Latacz 2004: 73–128; Niemeier 1998, 2003). The Ahhiyawa are first mentioned (in the earlier form *Ahhiya*) in the Madduwatta Letter, sent by Arnuwanda (reign circa 1400–1375 BC) to a rebellious vassal chief of the same name to complain of his traitorous activities. The letter recounts that Attarasiya, the "man of Ahhiyawa" and possibly the equivalent of the Helladic name Atreus, joined Madduwatta to raid Alashiya (Cyprus), a Hittite dependency (Bryce 2005: 129–35; Neimeier 2003: 104). Here we have unambiguous evidence of Mycenaeans participating in a naval raid, covering more than 500 kilometers in straight-line distance to reach Cyprus' westernmost shores. For the better part of the next two centuries, the Ahhiyawa enter the documentary record periodically in both peaceful and hostile interactions. For a time, the king of Ahhiyawa was accorded the title "My Brother," in the formulaic language of Near Eastern royal diplomacy, for example when Hattusili III (reign circa 1265–1240) remonstrated with the king of Ahhiyawa over the harboring of a fugitive; later in the thirteenth century, the Mycenaeans lost control of Miletos and the name of the king of Ahhiyawa was erased from diplomatic documents. It is difficult to overestimate the importance

of the Hittite texts as a unique source of information about Mycenaean activity in the Aegean, and more generally regarding the political geography of Asia Minor and the eastern Aegean. Their usefulness is fully realized when the archaeological record, particularly at Miletos, is seen to corroborate some of the events and relationships described in the texts. Miletos is the subject of a brief case study in Chapter 7.

Early Greek literary texts, particularly the *Odyssey* of Homer, are often called upon for insight on Mycenaean seafaring. We must be skeptical about attempts to read Bronze Age realities into a work set in writing half a millennium after the demise of the palaces, particularly as a growing consensus perceives the world that Homer describes as an Iron Age one (Bennet 1997; Morris 1997; Raaflaub 2006). Nevertheless, it is worth asking whether Homer's descriptions of the conditions of seafaring might apply to the Bronze Age. To what extent did ships and navigational technology (e.g., celestial navigation) change between the Late Bronze and Late Geometric periods? Had winds, currents, and other environmental conditions (such as harbor silting or built harbor constructions) changed in significant ways? Equally important is the possibility that persistent traditions of seafaring knowledge and certain maritime *mentalités* that had survived for centuries might be recoverable from Homer. These topics are explored in Chapters 3 and 4.

Iconographic Evidence

A large and constantly expanding literature addresses and debates the technical characteristics of ship form and construction in the Late Bronze Age Mediterranean. (General overviews can be found in Basch 1987; Mark 2005; McGrail 2001; Wachsmann 1998; Wedde 2000.) During the Bronze Age, images of ships were painted onto pottery and wall frescoes and incised, engraved, embossed, and impressed onto pottery, stone, seals and sealings, and metal jewelry. A surprising fact is that Aegean Bronze Age civilizations, ostensibly linked so closely with the sea, depicted watercraft so infrequently. A recent catalogue of ship representations from the Aegean Bronze Age counts approximately 80 painted ship images from sherds or whole vessels; more than 20 on the painted wall frescoes from the West House at Akrotiri on the island of Thera and a few others from fragmentary frescoes at Pylos, Iklaina, and Mycenae; 138 from seals and sealings; 43 incised, impressed, engraved, or embossed on ceramic, stone, or metal objects; nearly 50 watercraft models; and a further 26 as Cretan hieroglyphic or Linear A signs (Wedde 2000). In all then, we have fewer than 400 surviving images of ships for a period of 2,000 years.

Inferences about the ships depicted in iconographic representations are often controversial because there is no consistent artistic convention. Bronze Age artists did not necessarily attempt or achieve faithful reproductions of the

details of actual ships. This discrepancy may have resulted from deliberate stylization and abstraction (innovation), imitation of contemporary examples of ship iconography, or the use of a pattern book of ship icons. Often, the medium severely limited the amount of accurate detail that could be rendered: the miniscule working surface of seals necessitated executing many details in abbreviated, schematic form, and leaving others out altogether. Two-dimensional representations on any medium make it difficult to estimate a ship's beam or to interpret features such as appendages to the decks, bows, or sterns. Even in the larger formats of frescoes and pottery surfaces, details may be represented in ambiguous or stylized fashion, leaving modern scholars to speculate on the meaning of painted lines and other flourishes. These contingencies can make it difficult to reconstruct a typology of vessel types or to identify regional variability in ship construction.

A particular frustration is that within this limited corpus, virtually nothing is known about small boats of the kind that should have formed the backbone of short-distance maritime connectivity. Such small craft stand little chance of preservation as shipwrecks except in the kinds of contexts – peaty or waterlogged deposits, for example – that are rare in the Aegean. In the absence of hull remains, wrecks of small vessels, with their diminutive cargoes, are unlikely to be recognized as such by even the most fine-grained underwater surveys. Certain boat models and seals are thought to represent small craft, though scale is difficult to infer from them, and in general artists apparently preferred to depict the more impressive galleys and trading ships of the time. For this reason, the "Flotilla Fresco" from Akrotiri on the Cycladic island of Thera takes on a disproportionate significance in understanding Bronze Age Aegean small craft. The fresco's narrative scene shows a full range of vessel types, including several small canoe-like boats and other vessels of modest size, propelled by paddles, oars, and sails.

The Flotilla Fresco

The so-called Flotilla Fresco was part of a frieze that adorned the upper walls of Room 5 in the West House at Akrotiri on Thera. It occupied the southeastern corner of the east wall and the south wall of the small, 4 × 4 meter room (Warren 1979: 117, fig. 1). Opposite on the north wall, scenes of a shipwreck or sea battle are depicted, along with marching soldiers. The flotilla scene shows a procession of ships of various kinds, apparently leaving one coastal settlement (the "Departure Town") and arriving at the harbor of a second (the "Arrival Town"; Fig. 2.6). The second town is built above a double harbor formed by a larger and a smaller embayment divided by a narrow promontory. In both towns, spectators gather near the shore and in houses upslope amidst an atmosphere of excitement. The flotilla is composed of seven large sailing ships, highly ornamented with decorative elements, *ikria* (stern cabins), and awning

2.6 The Flotilla Fresco, West House Room 5, Akrotiri. Doumas 1992: 68, fig. 35. Courtesy of the Thera Foundation – Petrikos M. Nomikos.

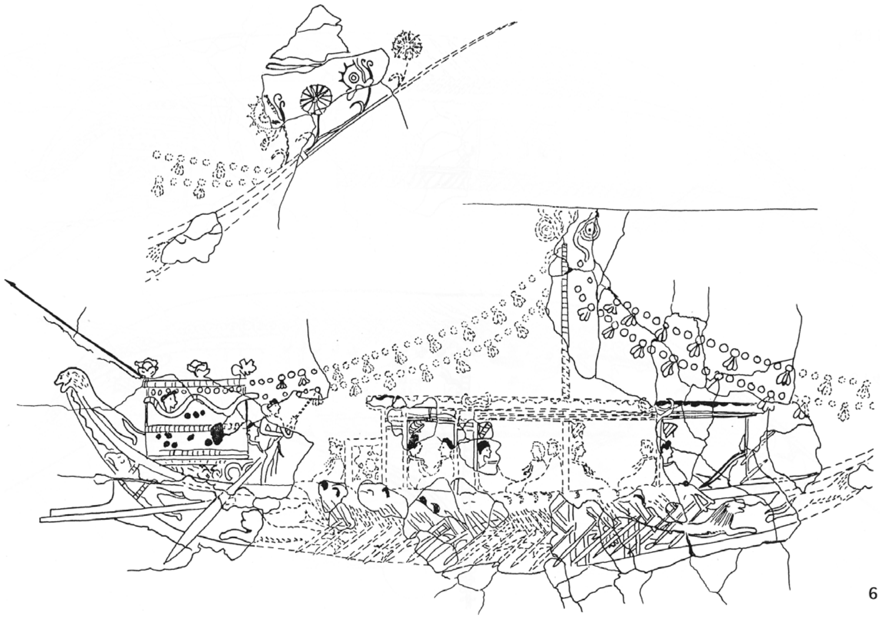
structures amidships under which well-dressed individuals sit. Only one of the ships is moving under sail, however. The rest are being paddled awkwardly by men straining to reach the water line. Seven other boats are part of the scene: one medium-sized boat is being rowed out of the Departure Town; two small boats with awning structures are moored in the larger of the harbors at the Arrival Town; three small canoes are drawn up on the beach of the smaller harbor of the Arrival Town; and one canoe is being rowed out to meet the arriving flotilla, perhaps to act as a pilot guiding the large ships to safe anchorage.

An interpretation of the scene as representing a ceremonial procession of some type is persuasive for many reasons (Marinatos 1974a; Morgan Brown 1978; Strasser 2010; Warren 1979). Most notable are the unusual circumstances of the ships and their occupants, which suggest that this could not be a routine military or commercial exercise. The large ships are all decorated at the prow and stern, and some have hulls painted with figural motifs or abstract designs. The most elaborate (Spyros Marinatos' "flagship") has a hull decorated with lions and dolphins, and a tall mast from which dress-ship lines festooned with crocus-bloom pendants run to the prow and stern (Fig. 2.7). The fact that six of the seven ships are being paddled is curious, because by LH I this archaic means of propulsion would have long been abandoned in favor of oar and sail, particularly for ships of this size as the paddlers' exertions attest. The other installations aboard the ships are similarly out of the ordinary, if not so quaint. The ikria are small stern cabins consisting of a framework of wooden posts hung with a screen of oxhide or woven fabric (Shaw 1980, 1982; Wedde 2000: 132–34), where the shipmaster or an honored guest might sit. Ikria are

also found as large-scale fresco motifs in Room 4 of the West House, and at Mycenae (Shaw 1980, 1982). Awning structures cover seated passengers who take no part in paddling the ship; boar's tusk helmets suspended from the roof of some awnings indicate that the passengers are soldiers. Their decorative tunics, stiff-looking and hiding their limbs, resemble the costume later worn by elite chariot passengers depicted on pictorial kraters of the thirteenth century BC. The ikria and awnings would have been a great hindrance to the efficient conduct of military or commercial business; it is believed that they were detachable structures that could be assembled for special occasions and then disassembled easily (Morgan 1988: 139; Shaw 1982: 55). The nature of the ceremony is a matter of speculation, but two of the more plausible suggestions are a nautical festival celebrating the inauguration of a new sailing season in spring (Morgan 1988: 143–45; Morgan Brown 1978), and a cultic procession commemorating the third-millennium Cycladic longboats (Wachsmann 1998: 108–113), which were sufficiently impressive and symbolically charged for their time to have lived long in memory. Because there is only one ship under sail, the ceremony might even reenact the introduction of the sailing ship to Crete toward 2000 BC.

The Flotilla Fresco is the single most important visual document of the Late Bronze Age for coming to terms with Aegean seafaring. It shows a range of ships and boats with sufficient realism that we can ascertain details about their form and construction, rigging and sails, methods of propulsion, and possible functions, in spite of the ceremonial modifications. The coastal scene also confirms some basic features of Bronze Age seafaring. The Arrival Town's double harbor, formed by a narrow headland with flanking embayments, was a preferred harbor topography in the Bronze Age. These are clearly natural harbors, as no durable harbor constructions are visible; instead three small canoes are pulled up onto the sandy beach of the smaller harbor, while two medium-sized vessels appear to be anchored in the middle of the larger harbor. The larger harbor may have a deeper approach suitable for bigger seacraft. The Minoans did have one kind of dedicated harbor structure, the ship shed, located some distance from the shore and used for storage of ships and nautical equipment during the winter months (see Chapter 5). A portion of the fresco on the north wall of West House Room 5 depicts soldiers marching to the right of a large building partitioned into narrow, open galleries facing the shore, very similar in form to Building P at Kommos, the best known archaeological example of a ship shed. Building P is dated to the later fourteenth century BC, some two centuries or more later than the Flotilla Fresco, but another putative ship shed at Gournia may have been built in MM IIIA (Watrous 2010), earlier than the Flotilla Fresco and indicating a long tradition into which the example at Akrotiri fits comfortably.

A detailed discussion of the watercraft depicted in the Flotilla Fresco is presented in Chapter 3, and further comment on the harbor setting is made



2.7 "Flagship" from the Flotilla Fresco, Akrotiri. Wedde 2000: Catalogue 616. Courtesy of Michael Wedde.

in Chapter 4. The main limitation of the Flotilla Fresco for our purposes is the chronological gap between the massive eruption that destroyed Akrotiri and the earliest verifiable representations of Mycenaean ships and boats. The debate over the date of the eruption is as contentious as ever (see recently the papers in Warburton 2009), but whether it occurred in the later seventeenth century or sometime in the sixteenth, the connection between the ships and boats of the Flotilla Fresco and the earliest ships represented in Mycenaean art in the later fourteenth century (LH IIIA2) would seem tenuous, but recent revelations of ship frescoes at Pylos and Iklaina may help to clarify the evolution of ship technology during the intervening period (Chapter 3).

Portrayals of Mycenaeans abroad are rare, and they seem only to be recognizable as soldiers wearing boar's tusk helmets. In addition to the Amarna papyrus, there is a warrior, possibly wearing a boar's tusk helmet, painted onto a sherd found at Hattusa and dated to circa 1400 BC (Niemeier 2003: 105, fig. 4). Mycenaeans were not among those painted on tomb walls in Egypt, as were the Cretans before them. Nor do any of the Aegean-style painted frescoes from the East – at Tel Kabri in Israel, Alalakh and Qatna in Syria, and Tell el-Dab'a in Egypt – appear to have Mycenaean connections (Cline et al. 2011).

Pottery and Other Media

Continuing on the theme of the relationship between the Minoan/Cycladic and the Mycenaean seafaring traditions, illustrations of distinctly Mycenaean ships

on pottery and other media are curiously late. The Mycenaean oared galley, which may have been an entirely new design (Wedde 2005: 29), is first portrayed on pottery in LH IIIB, but not in great numbers, and other types of craft are generally not depicted at all. Surprisingly, images of the galley on pottery increase after the collapse of the palaces in LH IIIC, a pattern that has social and artistic dimensions that are explored in Chapter 3. Ship images on pottery are subject to all of the ambiguities of artistic representation, with the additional challenge of working on a curved surface.

Boat models in clay are the only three-dimensional representations of Bronze Age watercraft (Fig. 2.8). Models help give a sense of the beam, as well as features such as keels (either painted, or represented three-dimensionally as swellings or protrusions in the clay) and thwarts. Some surely represent small boats rather than the larger ships that predominate in all other media, but their typically crude execution makes determination of dimensions speculative. Of the approximately 50 whole or fragmentary boat models, more than 20 have been found on the mainland, and these range in date from LH IIIA to LH IIIC (Wedde 2000: 307–312). EBA boat models come from Crete and the Cyclades; during the MBA they are limited to Crete; and in the LBA they are found on Crete, in the Cyclades, and on the mainland. Most of the boat models survive as fragments only, limiting the amount of useful information that can be extracted from them.

Seals and sealings with ship imagery come almost exclusively from Crete, where the corpus numbers more than 125, with increasing frequency through the Bronze Age until the destruction of the neopalatial palaces at the end of LM IB (Wedde 2000: 331–49). Fewer than ten have been found on the mainland, in contexts ranging from EH III/MH I to LH IIIB. These undoubtedly represent sporadic arrivals from Crete. As mentioned above, realistic details are difficult to render on such small surfaces, and to make matters more challenging there is a large subclass, the so-called talismanic seals, with particularly abstract designs (Wedde 2000: 134–41).

Shipwrecks

Shipwrecks are of immeasurable value in offering single-event horizons and the possibility of full assemblages of associated material being preserved together, though the remains are still susceptible to decay, movement or destruction by currents or sea creatures, and mixing with other wrecks and dumping events. They are direct material evidence for the form and construction of ships and boats; for the cargoes, personal effects, and subsistence items taken on board; and for the location of the vessel when it foundered. The frequent preservation of organic material can open a world of information about the use of substances that rarely survive in the terrestrial archaeological record; the Uluburun project is a

2.8 Clay boat model, Asine LH IIIC. After Spathari 1995: 51, fig. 51.

shining example of the vast amount of new information that can be gleaned from specialist analyses of the excavated materials. Indirectly, the ship's contents can enlighten about the origin, movements, and final destination of the doomed voyage; about the modes of exchange and purposes of travel represented; and about the social, political, and economic conditions of the time.

Three LBA shipwrecks in the Mediterranean have been thoroughly excavated and published to date: the Uluburun and Cape Gelidonya wrecks off Turkey's southern coast, and the wreck at Point Iria in the Argolic Gulf on the Greek mainland. A fourth excavated shipwreck, a Minoan ship of MM IIB date off the coast of Crete at Pseira, is nearing publication (Hadjidaki and Betancourt 2005–2006, 2006). A fifth, near Şeytan Deresi on the southwestern coast of Turkey, was fully excavated and described in preliminary reports (Bass 1976; Margariti 1998), but is not considered here because there is a high probability that it does not actually belong to the Bronze Age (Bass 2005d). Other underwater concentrations of artifacts that have been interpreted as Bronze Age shipwrecks, although without the benefit of timber remains or systematic excavations, include Aegean wrecks off Dokos island (EBA) and at Kyme off the coast of Euboea (LBA, with nineteen "pillow" type copper ingots); and a number of scattered cargo sites on the Israeli coast that are difficult to interpret (Lolos 2001; Wachsmann 1998: 205–211). In the absence of excavation, we cannot rule out that the remains may represent palimpsests of material from multiple wrecks, or mixed shipboard and land-based debris near harbor sites.

The problem of working back to the Bronze Age ships represented by these sites is exacerbated by the near absence of surviving ship remains. Only the Uluburun and Gelidonya shipwrecks have produced small amounts of hull remains, on which basis the Uluburun ship is estimated to have been 15 meters long and 5 meters wide, and the Gelidonya ship 9–10 meters long but of uncertain width. This material provides crucial information on such aspects of shipbuilding as general hull construction and joinery methods, but is insufficient to furnish independent confirmation of inferences drawn from iconography on a host of unresolved questions. Neither of these wrecks is likely to be a Mycenaean vessel, but as types they must have been familiar in the Aegean.

The most interesting aspect of the four excavated shipwrecks is that they possess contrasting cargo assemblages and exemplify a range of distinctive modes of exchange, as defined above. The Uluburun wreck, with its enormously valuable cargo of precious metals and other luxuries, epitomizes the directional, emissary exchange so vividly described in Near Eastern texts, while at the same time carrying large quantities of non-elite commodities such as poor-quality Cypriot pottery, which merchants on board operating in freelance mode could trade at ports of call (Pulak 1997, 1998). The Gelidonya ship also carried raw metals: 34 copper oxhide ingots (about one ton), 20 bun and 19 slab ingots of bronze, and a few badly degraded tin ingots; more prominent, however, is an inventory of more than 250 pieces of bronze scrap along with intact tools for coppersmithing, and the absence of luxury finished objects and raw materials such as ivory (Bass 1961, 1967, 1988, 1990). The Gelidonya ship is seen as a prime example of independent, entrepreneurial cabotage, that is, freelance exchange, but with a specific focus on itinerant metal working. This in itself is fascinating, because itinerant artisans are often postulated to explain the appearance of foreign styles, but rarely are the toolkit and the peripatetic lifestyle of the itinerant craftsman so clearly captured. The Point Iria and Pseira shipwrecks seem to have been small ships plying local networks with cargoes of foodstuffs and other staples transported in utilitarian pots, though there are some points of difference. The cargo of the Point Iria wreck is composed exclusively of pottery (a small anchor found nearby may also belong to the wreck) of three distinct groups: eight Cypriot pithoi, eight Cretan LM IIIB2 transport stirrup jars, and nine assorted Helladic vessels, mainly storage jars and amphoras, but also including a decorated deep bowl that helps to date the entire assemblage to LH IIIB2, probably closer to 1200 BC. With this sort of mixed assemblage, several interpretations of the ship's origin, movements, and mission are possible. It may have left a home base on Cyprus, traveled to Crete, picking up commodities packed in coarse stirrup jars, and continued on to the Argolid – where we know Tiryns had ties to Cyprus and Crete at the time – to conduct business and pick up mainland goods, before finally wrecking on the shallows off Point Iria. Because these transport vessels are so portable, however, the ship could equally have come from Crete, or perhaps most likely of all, it belonged to a local trader carrying produce to neighboring settlements in the Gulf in recycled storage vessels (Dickinson 2006: 35). Cheryl Ward (2010: 157) cogently interprets the Point Iria wreck as ". . . the cargo of a small, open boat, not unlike a small modern caique, taking on merchandise at a central location and then traveling within a close-knit network of settlements along the coast." She also reminds us that the detailed and imaginative reconstructions of the ship and its activities that have been published have no basis in material evidence (Ward 2010: 157; see Vichos 1999 and especially fig. 16). Finally, the Pseira wreck is dated to MM IIB (roughly the middle to late eighteenth century) by dozens of complete

transport amphoras and hole-mouthed jars in local fabrics of the Mirabello region (Hadjidaki and Betancourt 2005–2006: 84–85; P. P. Betancourt, personal communication, 2011). The local provenience and utilitarian function of the pottery have led the excavator to the provisional interpretation of the wreck as a small ship engaged in local-scale trade around the Gulf of Mirabello, which we might imagine as the center of a maritime small world. In the Point Iria and Pseira shipwrecks we have, at last, a glimpse of local-scale maritime networks.

Environmental Evidence

As emphasized in the first chapter, the environmental settings of Mycenaean coastal worlds are anything but static; they are constantly undergoing modification by human and natural agents. Some systems are more stable than others. As we shall see in Chapter 4, the weather- and climate-related phenomena that make up the Mediterranean maritime environment – including winds, currents, temperature, and storm patterns – fluctuate on a regular basis but in their broad patterns have not diverged significantly since the Bronze Age. The ability of mariners to cope with environmental challenges through technology and experiential knowledge may have changed radically through the ages, however, so we cannot assume, for example, that Mycenaean captains and navigators possessed the same skill set as Homer's or Hesiod's seafarers.

The changes that have occurred in coastal landscapes and seascapes are generally more extreme, and these are examined in Chapter 5. Coastlines are exceptionally vulnerable to a host of natural alterations resulting from earth processes operating at scales from global to local. Global sea-level change has had a strong effect in some areas. In particular, a maximum marine transgression some 6,000 or 7,000 years ago that flooded Mediterranean land masses and created vast embayments on many Mediterranean coastlines was followed by a stabilization of global (eustatic) sea level and the gradual infilling of these bays with sediments over time. One result is that certain important harbor sites that were open to the sea in the Bronze Age – Troy, Ephesos, and Miletos on Asia Minor's Aegean coast are striking examples – are now stranded literally kilometers inland today. An even more insidious process – because it is more localized and harder to detect on the landscape – is tectonic activity. In the earthquake-prone Aegean region, subsidence and uplift are common coastal processes. There may be regional tendencies – for example, the Corinthia, where the Corinthian Gulf coast is rising while the Saronic Gulf coast is subsiding – but the complexity of the fault systems is such that sites separated by only a few kilometers on the same coastline can have quite distinct tectonic histories (Nixon et al. 2009). Human activities may promote change in coastal embayments, usually by accelerating rates of sedimentation through practices such as extensive agriculture and grazing, which release soil to be eroded and transported to the sea.

Even relatively small changes in a coastline can have transformative effects, rendering a once-inviting harbor unusable by separating it from the sea, making the approach too shallow, altering its protective configuration, or leaving a new set of navigational hazards in the inshore waters. These changes exacerbate the already low visibility of Mycenaean anchorages that can be attributed to the fact that Bronze Age communities did not build permanent harbor facilities such as piers, quays, or breakwaters, so far as we know. Instead, they pulled smaller boats onto the beach, or anchored just offshore, exactly as depicted in the Flotilla Fresco at Akrotiri. Changes in the coastline play a key role in understanding all of the coastscapes examined as case studies in Chapter 7 (Kalamianos, Miletos, and Dimini).

Integrated methods of geomorphological observation, geological coring, and geophysical prospection for paleocoastal reconstruction are well established in the Mediterranean, and the database of case studies of the coasts of Greece and Turkey is constantly growing. The basic principles and many examples of this work are examined in Chapter 5, and the prospects for integrating such programs with archaeological investigations of local and regional maritime worlds are assessed. These studies are essential, but they are expensive and time consuming; they often require many seasons of fieldwork and the results of various analyses may appear only gradually over a period of years. Particular care must be taken that the archaeologist and earth scientist share compatible understandings of the problems being addressed and the expectations of results.

Historical and Ethnographic Evidence

One of the benefits of gathering information from historical, recent, and living societies is that, like a well-preserved shipwreck, they offer categories of data that are nearly impossible to recover in a prehistoric archaeological context, and they provide insight on how materials are created, used, and discarded in living societies. And like shipwrecks, they can alert the archaeologist to new ways of thinking. The dangers of simplistic application of ethnographic analogy are well known; the past is indeed a "foreign country" and the gulf that divides the Bronze Age from today must be kept clearly in focus. Yet ethnographic and ethnoarchaeological studies may provide plausible comparative data and even models for Mycenaean coastal worlds. There are numerous ethnographic studies of maritime societies and maritime cultural landscapes around the world, a good many in Oceania, where ancient traditions of seafaring persisted on isolated islands until recently. Several categories of information might be queried for useful comparisons and contrasts; among these are shipbuilding and navigational technology, the organization of maritime coastal communities, and the transmission of maritime knowledge from one generation to the next. In some of these areas, the practices of South Pacific seafarers are exceptionally enlightening,

for example the preservation and transmission of maritime knowledge, and the status of the maritime community within the larger society. I incorporate discussion of these points as they relate to Mycenaean seafaring in several chapters.

It may be possible to get this kind of information closer to home. As part of the Saronic Harbors Archaeological Research Project (SHARP), which I co-direct with Daniel J. Pullen (Tartaron et al. 2011), our colleague Lita Tzortzopoulou-Gregory collected a number of oral histories in interviews with older residents of Korphos, until recently a traditional fishing village. A major focus of these interviews has been to record as much information as possible about life in a maritime coastal community prior to the adoption of motorized boats and before the advent of the modern economy; that is, before the Second World War. The results are, in my opinion, scintillating, because they bring to life aspects of the maritime orientation and economic organization of the community, as well as patterns of interaction by sea that are not merely economic but also social, in the same Saronic setting where the Mycenaeans prospered in the thirteenth century BC. Information from the oral histories is assessed in the Saronic Gulf case study in Chapter 7.

A Note about Theory

This book is not conceived as a heavily theoretical work, but an essential component of my approach is a theoretical framework that explicitly identifies a structure for maritime interaction at all spatial and temporal scales, and offers a model for the way that these systems are expected to work that is empirically testable. I provide this in Chapter 6, where I begin by focusing on the uniqueness of the coastal zone as a useful empirical category. Then, in order to construct a dynamic framework for interaction in Aegean coastal zones, I adopt the *maritime cultural landscape* (Westerdahl 1992) as an overarching concept, and proceed to define four distinct but nested *maritime interaction spheres* that comprise it, based primarily on geographical scale but also incorporating cultural dimensions. From smallest to largest, these are the *coastscape*, the *small world*, the *regional/intracultural maritime interaction sphere*, and the *interregional/intercultural maritime interaction sphere*. I draw on social network theory to explain the mechanisms by which these relationships are established and change over time. These concepts are applied to the case studies explored in Chapter 7. More generally, my hope is that this theoretical framework is sufficiently useful and flexible to be adopted in modified form in a range of times and places.

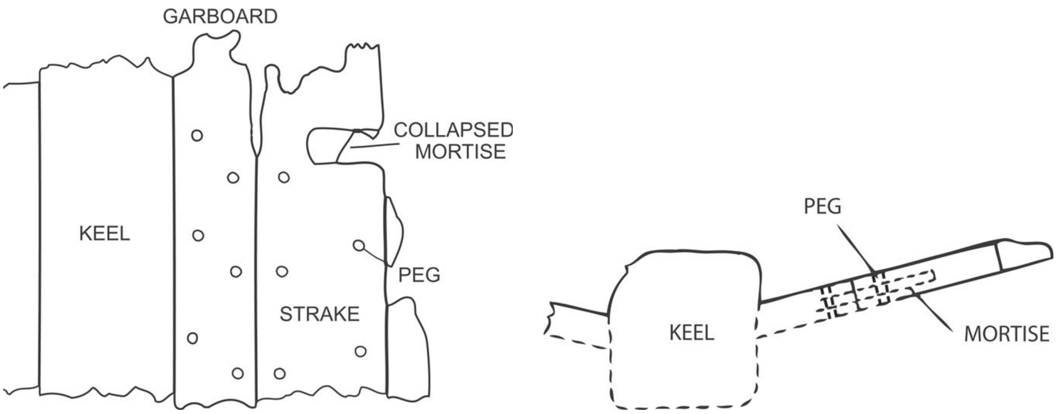
THREE

SHIPS AND BOATS OF THE AEGEAN BRONZE AGE

An essential baseline for understanding the coastal interface between sea and land in the Aegean Bronze Age is knowledge of the ships and boats active at that time: the range of their forms and functions, their operating limits and geographical ranges. A voluminous and constantly expanding scholarship exists on all aspects of Aegean Bronze Age seacraft (Basch 1987; McGrail 2001; Tzalas 1989, 1995a, 1999, 2001, 2002; Wachsmann 1998; Wedde 2000). Much of this discussion remains speculative because, as we have seen, there are few surviving physical remains, and many of the details shown on images and models of Bronze Age vessels are highly ambiguous as to identity and function. Moreover, certain classes of craft that must have existed are represented poorly or not at all. The objective of this chapter is to summarize the salient features that are known or can be inferred about Bronze Age, particularly Mycenaean, seagoing and coast-riding vessels. Here and in the chapters to follow, ship images are cited using the numbering system of Michael Wedde's catalogue in *Towards a Hermeneutics of Aegean Bronze Age Ship Imagery* (Wedde 2000). In an image citation, a reference such as W612 simply means Wedde, catalogue number 612 (one of the Flotilla Fresco vessels). The virtues of Wedde's system are that it is rational and easy to use, each item is illustrated and discussed thoroughly, a handy concordance with other catalogues is included, and it is easily accessible in libraries.

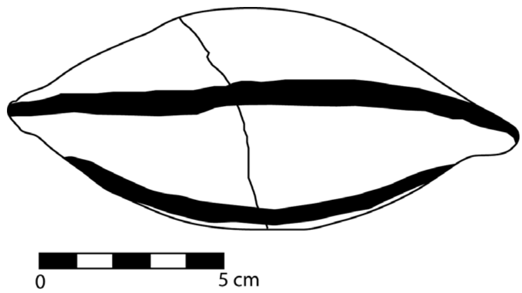
General Characteristics of Mediterranean Bronze Age Ships and Boats

All evidence suggests that Mediterranean Bronze Age vessels were constructed hull first rather than frame first, and there is in fact no certain evidence of frames in the small amount of hull material recovered to date (Pulak 2002: 616).



3.1 Mortise-and-tenon joinery. Drawing by Felice Ford after Wachsmann 1998: 216, fig. 10.2.

The earliest known frame-first ships date to the mid-first millennium AD, based on recent finds from Tantura Lagoon near Haifa (Kahanov 2001, 2009) and the Theodosian Harbor at Istanbul (Pulak 2009). There were two basic methods of joining the planks and other structural members of the ship: mortise-and-tenon joinery, and lacing or sewing (Fig. 3.1). The two Mediterranean Bronze Age shipwrecks from which pieces of the hull have been preserved, those at Uluburun and Cape Gelidonya, were both made with locked mortise-and-tenon joinery (Bass 1989; Pulak 2002). Mortise-and-tenon joinery is well known from earlier and contemporary Egyptian vessels (McGrail 2006: 60), but the technique of locking or pegging the tenons into place with treenails was possibly an innovation of Canaanite shipbuilders in the mid-second millennium BC.[1] The locked mortise-and-tenon joint was part of a wider repertoire of woodworking techniques, as illustrated by roughly contemporary tables excavated at MB II Jericho (circa 1750–1650 BC: Wachsmann 1998: 240–41, fig. 10.28) and in Shaft Grave V at Mycenae (Muhly 1996). Despite the fact that the Uluburun and Gelidonya hulls were joined in this way, ships with sewn planking persisted well into historical times. The hulls of a number of Mediterranean wrecks from the period 600–100 BC are either fully sewn or partly sewn and partly joined by mortise and tenon (Mark 2005: 45–68; McGrail 2006: 61).[2] Most experts accept, however, that the Uluburun and Gelidonya ships were of Levantine or Cypriot, not Mycenaean, origin. There is no consensus on when shipwrights in the Aegean world began to employ mortise-and-tenon joints. Some interpret the boat that Odysseus fashioned to depart from Calypso's island (*Odyssey* 5.234–57) as a mortise-and-tenon joined boat (e.g., Casson 1995: 217–19), which would establish the Late Geometric period as the minimum age for this technique's appearance in the Aegean. Others, however, read into the same passage a sewn vessel (Mark 2005: 94), and Samuel Mark (2005: 63–64) in fact places the transition from sewn to mortise-and-tenon joinery in the sixth century BC,

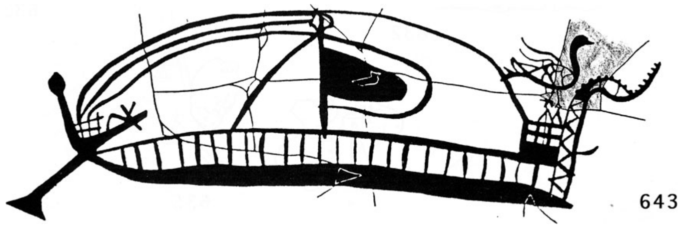


3.2 Painted keel on boat model, Asine LH IIIC. After Vichos and Lolos 1997: 333, fig. 21.

as a specific modification to accommodate large, heavy amphora cargoes and burgeoning polis-supported navies. We cannot assume that the Mycenaeans used this technique, but even if they did, many hulls, particularly those of smaller ships and boats, undoubtedly continued to be partially or completely sewn.

The Uluburun ship had a keel that projected into the interior of the hull, rather than outward as was typical of most ancient Mediterranean hulls (Pulak 2002: 618–19). Boat models from the Mycenaean world of late palatial and postpalatial times show the keel as a painted longitudinal line on the inner bottom surface (e.g., Kynos LH IIIC models W332, W333; Fig. 3.2) or a protrusion on the external bottom surface (Mycenae LH IIIC model W312; Karaminou 2002: 446).

A range of appendages and devices on the bow, stempost, and stern are portrayed on the ships of the Flotilla Fresco (Wedde 2000: 119–30, figs. 9–11; see Fig. 2.7). The larger vessels have bowsprits, or spars, running from the stempost as decorative devices or to fasten the stays (Wedde 2000: 215). Those on the ships participating in the procession are long and decorated with symbols of birds, dolphins, butterflies, and suns. These sprits were apparently detachable (Wedde 2000: 120). Elaborate bowsprits are not characteristic of Mycenaean vessels, but the stempost (the upright continuation of the keel at the bow) often terminates in the head of a bird or other animal, sometimes rendered realistically and in other cases abstractly (Fig. 3.3). These figured stemposts are diagnostic of late Mycenaean ship depictions of LH IIIB and LH IIIC (Wedde's [2000: 123–24] Skyros and Tragana clusters). The prevalence of bird heads as figureheads accords well chronologically with the depiction of birds (along with other motifs including fish, bulls, octopi, and chariot scenes) often rendered in a similar fashion on painted Aegean and Aegean-style pictorial pottery beginning in LH IIIA in the Argolid at Mycenae and Tiryns (Günter 2000). Subsequently in LH IIIB, an industry centered in the Argolid produced pictorial vessels for export to Cyprus. In LH IIIC, this tradition continued with the "Close Style" at Mycenae and Tiryns, and with other local styles in Greece, the eastern Aegean Islands, coastal Asia Minor, and Cyprus. This tradition then influenced the Philistine

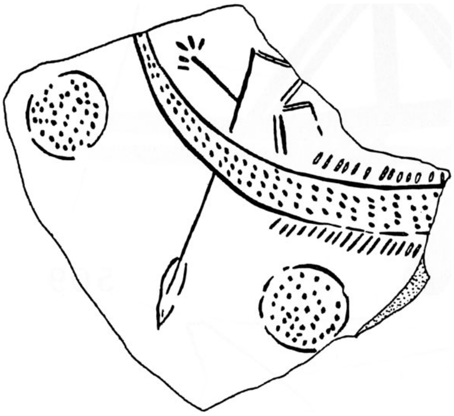


3.3 Bird-head stempost decoration on a straight-sided alabastron, LH IIIC Middle, Tragana. Wedde 2000: Catalogue 643, after Korres 1989: 200. Courtesy of Michael Wedde.

Monochrome and Bichrome pictorial pottery as migrants from the Aegean and Cyprus contributed culturally to the formation of the historical Philistines in the twelfth and eleventh centuries (Bunimovitz 1998; Dothan 1998; Yasur-Landau 2005, 2010). Thus the pattern of bird motifs on pottery and ship representations demonstrates continuity bridging the Aegean palatial and postpalatial worlds and involving broad maritime contacts (Meiberg 2011).

Ships and boats were propelled by one or more of three instruments: paddle, oar, or sail (Wachsmann 1998: 247–54).[3] Anyone who has paddled a canoe and rowed an oared boat will immediately understand the difference in these means of propulsion. Paddling was the earlier form and rowing an innovation in which the pivoting of an oar on a grommet or oarlock increased power and used energy more efficiently. Although paddling continued in use during the Bronze Age in small craft and for cultic use, oared vessels were well established by the later third millennium in Egypt. In the contemporary EBA Aegean, longboats of the Cycladic islands employed up to 25 or more paddlers (Broodbank 2000: 99). It is possible that the shift from paddle to oar as the primary means of propulsion took place as part of an infusion of maritime technology that also brought the sail to the Aegean near the end of the Early Bronze Age. This transformation is evident in the changing depictions on pottery, seals, and models that characterize the developmental sequence from Wedde's "Syros" (EC/EM/EH II) to "Platanos" (EM III–MM III) types (Wedde 2000: 45–52). These changes had other implications for hull design, including broadening the beam to accommodate the mast and rigging as well as the positioning of oars and oarsmen.

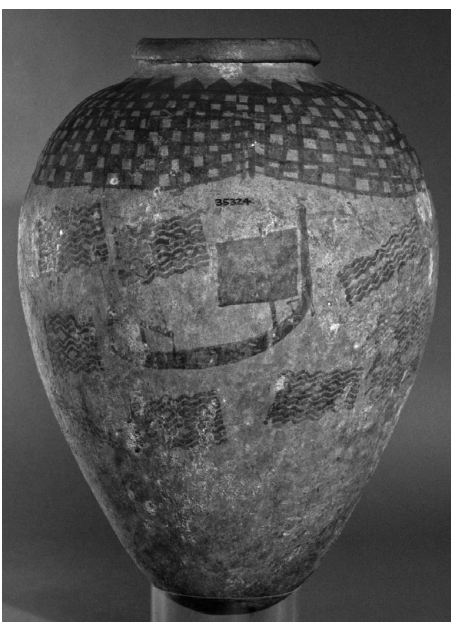
Another prominent feature related to propulsion was the steering oar (or quarter rudder, taking the name from its usual position projected over the starboard quarter near the stern), almost certainly attached to the side of the hull by some kind of strap.[4] The steering oar's function is to redirect water past the hull to impart a turning motion to the vessel, and by 3000 BC in Egypt it was found to be a necessary aid to steering. The earliest clear depiction in the Aegean of a steering oar, in this case with a tiller attached, comes from an Early Cycladic III *askos* from Phylakopi (W416; Wedde 2000: 314; Fig. 3.4). There is a general evolution of the steering oar during the Bronze Age, particularly in



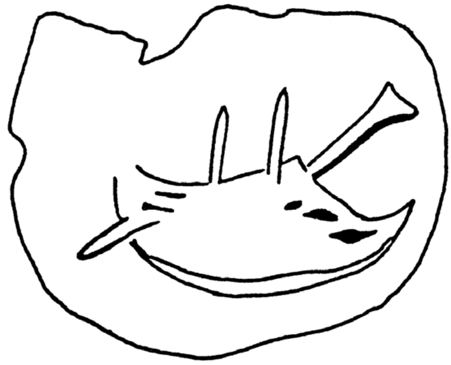
3.4 Early steering oar on an Early Cycladic III sherd. Wedde 2000: Catalogue 416, after Atkinson et al. 1904: pl. V.8c. Courtesy of Michael Wedde.

the form of the blade (Wedde 2000: 60–62, fig. 7). Earlier depictions from the Cyclades and Crete show a spindle- or leaf-shaped blade, while the Mycenaean blade of LH IIIC was larger and thicker, with a triangular shape. Normally, one steering oar is depicted on the starboard quarter, but rarely there are two (e.g., the ship under sail in the Akrotiri Flotilla Fresco; W617) or even three.

The earliest certain depiction of a sail in the Mediterranean occurs in Egypt on a Naqada II (Gerzean) pottery vessel dated between 3500 and 3100 BC (Fig. 3.5).[5] The image depicts a ship bearing a single square sail positioned well forward toward the prow, in clear contrast to the conventional positioning of the sail amidships in Bronze Age iconography and models.[6] The position of the sail forward of the center of the hull's profile has been interpreted as part



3.5 Earliest Mediterranean depiction of a sailing vessel, on a Naqada II (Gerzean) jar, Egypt. © Trustees of the British Museum.



3.6 Steatite seal with a ship and possible steering oar, Siteia district, EM III or MM I. Wedde 2000: Catalogue 707, after Xenaki-Sakellariou 1958: pl. 18.79a. Courtesy of Michael Wedde.

of an early evolutionary stage in ship configuration (Casson 1995: 19), but to modern ship designers, the center of the sail area is properly shifted forward if the vessel is to sail into the wind or with the wind direction forward of the beam (Tilley 1999).

The sail was probably introduced to Crete via Egypt just before 2000 BC (Broodbank 2000: 341–47; Yule 1980: 164–66). The earliest certain evidence for the sail in the Aegean comes from a series of Minoan seals from EM III and EM III–MM I contexts (Wedde 2000: 331–33; W701–713), showing ships with a single mast amidships, two or three fore- and backstays, and variable numbers of oars. At least one (W707) may show a steering oar (Fig. 3.6). The high, sweeping stern- and stemposts form the crescent shape characteristic of Cretan vessels through the MBA and into the early phases of the LBA, as is plainly shown in the Akrotiri fresco a half-millennium later.

Until the last phase of the LBA, the square or rectangular sail was stretched between a yard and a fixed boom, and furled by lowering the yard to the boom. This boom-footed rig presented certain limitations (Wachsmann 1998: 248–54). With the fixed boom, the ship had limited ability to sail into the wind; when not traveling before the wind, the crew's options narrowed to lying at anchor or taking up oars. Further, the sail could not be taken in, so to reduce sail the crew was forced to remove the sail and raise a smaller one, not a simple matter with an unwieldy cable system. The results of preliminary sailing experiments with a replicated boom-footed square rig do not contradict these assessments (Raban and Sterlitz 2002).

A significant innovation of the Bronze Age was the brailed rig with a loose-footed sail, which replaced the boom-footed rig after 1200 BC. In this new configuration, the boom disappeared altogether, replaced by lines (brails) attached to the foot of the sail and threaded up the sail through brailing rings sewn onto the sail. The sail could now be furled by simply pulling on the brails to raise it up to the yard, saving considerable time, effort, and manpower (Wachsmann 1998: 251) and making the ship more responsive to changing conditions at sea. The transition from boom-footed to brailed rig is clearly illustrated in the Aegean.

When rigging is identifiable in images of LH/LM IIIB (thirteenth century BC) or earlier, it is almost invariably of the boom-footed type,[7] but most LH IIIC examples of the post-1200 BC period employ the new brailed rig (Wachsmann 1998: 251; Wedde 2000: 80–87). Elsewhere, shortly after 1200, the naval battle scene from the north wall of the mortuary temple of Ramesses III at Medinet Habu shows the ships of both Egyptians and Sea Peoples with brailed rigs (Casson 1995: 36–38, fig. 61; Raban 1995). The brailed, loose-footed sail seems not to be an Egyptian or Aegean innovation, however. Some interpret the Sea Peoples' ships as Syro-Canaanite (Wachsmann 1998: 163–98). Earlier depictions of Syro-Canaanite ships may or may not carry brailed rigs. An oft-cited example is a craft of Syro-Canaanite type painted in the tomb of Nebamun at Egyptian Thebes, dating to the reign of the Eighteenth Dynasty pharaoh Amenhotep II in the last quarter of the fifteenth century BC. The rigging has been interpreted as supporting a loose-footed sail (Raban 1995: 355), but the part of the painting where the boom would be positioned is not preserved, and several scholars have reconstructed the ship with a standard boom (Wachsmann 1998: 45–47, figs. 3.6–3.8).

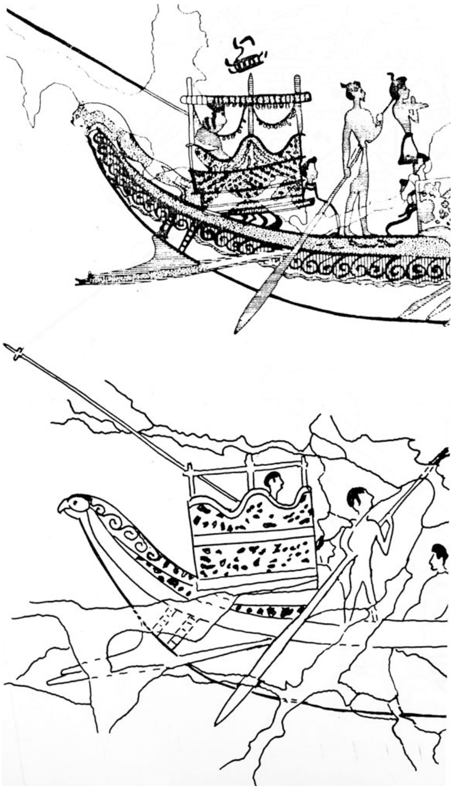
Various features depicted on the decks and hulls were probably detachable furniture reserved for ceremonial occasions. On both larger and smaller ships in the Flotilla Fresco, a prominent framework composed of vertical stanchions and horizontal roofing beams forms an awning-like structure that occupies almost half the length of the hull (see Fig. 2.7). The framework creates several compartments in which numerous robed figures are seated. Because boar's tusk helmets hang from some of the compartments' roofs, along with what may be weapons stacked on top, these figures have been interpreted as representations of soldiers (Warren 1979: 119), though they could be VIPs of another type (Morgan Brown 1978). This structure is limited mainly to the Akrotiri fresco of LM IA and the Miniature Wall Painting at Ayia Irini of slightly later date in LM IB/LH II (W672–76; Wedde 2000: 327–28). At that time, Ayia Irini in the northern Cyclades had strong ties to the southern Cycladic and Minoan worlds. A gold signet ring found near Tiryns and dated on stylistic grounds to LH II depicts a similar structure, with two passengers seated face to face under the awning (Fig. 3.7).[8] Several salient points emerge from studies of the awnings. They occur on frescoes in the Cyclades and seals on Crete, in a relatively narrow time horizon in the middle of the second millennium BC, but with the exception of the (surely imported) Tiryns ring, they are not found on the Greek mainland at any time. They appear in pictorial contexts that are strongly ritual or ceremonial in nature – the elaborate ornamentation, fanfare, and deliberately archaizing propulsion at Akrotiri, and intimations of feasting at Ayia Irini. Since such large structures would have proved a hindrance both to sailing and rowing, as well as cargo capacity, it is safe to conclude that these were detachable structures assembled onboard for special events and disassembled afterward. Ships configured

3.7 LH II signet ring showing awning structure, Tiryns. © Hellenic Ministry of Education and Religions, Culture and Athletics/Archaeological Receipts Fund. Courtesy of the National Archaeological Museum, Athens.

with this special furniture may not have been taken very far from shore, if the Akrotiri and Ayia Irini scenes are any indication.

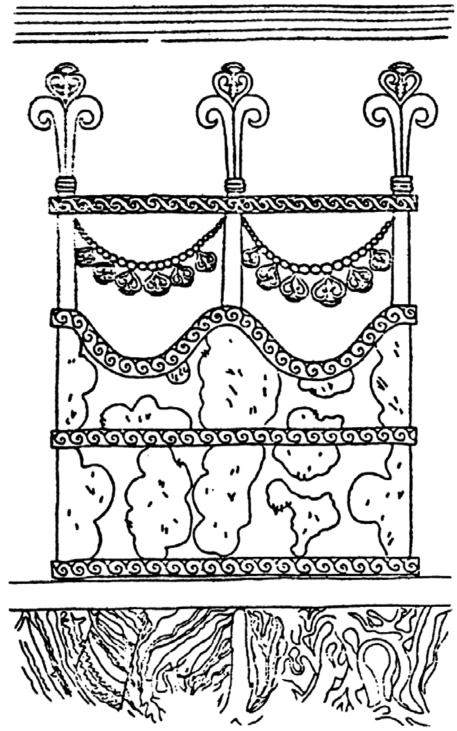
Another kind of deck furniture has greater relevance for the Mycenaean world. An elaborately decorated ship cabin, or *ikrion* (pl. *ikria*), present on the sterns of all of the larger ships in the Flotilla Fresco procession, was in essence a screen of oxhide or woven fabric on a framework of poles and crossbars, which presumably housed a seat for the ship's captain or some other important official (Shaw 1980, 1982; Wedde 2000: 132–34; Fig. 3.8). The ikrion was unroofed – as clarified by the heads of occupants protruding over the top of the framework – and open on the side facing the bow. Like the awning structure, it was detachable, but it may have been mounted on a permanent platform built onto the stern deck (Shaw 1982: 56, fig. 5). Maria Shaw (1982: 55) characterizes the ikrion as a light, flexible tent-like structure that could easily be disassembled and stored.

Apart from the Flotilla Fresco, images of ships with ikria are relatively rare and date mainly to LM I/II. They include a seal (W910) of MM IIIB–LM I type possibly found near Thebes, a number of "talismanic" seals predominantly from Crete or of unknown provenience, and a few examples of Linear A sign *86 that may incorporate ikria. The renderings of ship components in these last two categories, highly stylized in the talismanic seals and schematic in the Linear A script, make readings as ikria a matter of interpretation. A stone vase with relief decoration found near Epidauros contains a depiction of a ship with an ikrion in an anomalously late LH IIIB context (W642; Wedde 2000: 324). Like awning structures, ikria appear in ceremonial scenes. They are not depicted on Late Mycenaean galleys shown engaged in naval battle, for example, or on any of the nonceremonial ships in the Akrotiri fresco.



3.8 Ikria from two of the Flotilla Fresco ships, Akrotiri. Wedde 2000: Catalogue 614 (top), after Marinatos 1974b: 140, fig. 26; and 615 (bottom). Courtesy of Michael Wedde.

Another class of ikrion representations forges a more direct link with the Mycenaean world. The main decoration on the walls of Room 4 of the West House at Akrotiri, adjacent to the room containing the Flotilla Fresco, was a continuous frieze of eight painted ikria (Wachsmann 1998: 94; Warren 1979: 119; Fig. 3.9). M. Shaw (1980, 1982) has convincingly reconstructed painted stucco fragments excavated in 1886 in a small room just north of the Megaron of the palace at Mycenae as part of a comparable frieze of at least four ikria. The room is interpreted as belonging to a domestic quarter within the palace complex, similar to the inferred function of West House Room 4. The Mycenae ikria, along with additional fresco fragments from the Mycenaean palace at Thebes that may illustrate an ikrion in association with a female wearing a flounced skirt, and the Epidauros relief vessel mentioned above, combine to make a strong case for the survival of this particular emblem through a half-millennium of changing relationships and ship forms. Found in highly elite contexts at Akrotiri, Mycenae, and Thebes, the ikrion can be understood as a symbol of nautical power transmitted among those elites whose power rested partially in the control of sea routes by which access to raw materials and privileged relationships was secured. The recent recognition that fragments of a wall painting from Hall 64 at the Mycenaean palace at Pylos constitute parts



3.9 Ikrion frieze from West House Room 4, Akrotiri. Shaw 1980: 176, ill. 8. Courtesy of Maria C. Shaw and the Archaeological Institute of America.

of a ship with a brailed rig (Shaw 1980, 2001) highlights the underappreciated role of the nautical realm in the visual language of Mycenaean power.

Types of Mycenaean Seacraft

It is possible to recognize certain distinct types of vessels plying the Aegean in the LBA, and to hypothesize the existence of other types for which we have little or no direct evidence. Two basic functional types that have been projected onto the Bronze Age data are the *merchantman* and the *galley* (Wedde 2001: 609).[9] The merchantman was a trading vessel designed to maximize cargo capacity. To do so, the space available for rowers and other crew was reduced. With diminished capacity for propulsion by rowing, the merchantman was a true sailing ship that could operate with a minimal crew, but relied on wind power and used oars for limited tasks such as maneuvering within harbor areas. The design of the merchantman hull favored a broader beam, i.e., a larger width to length ratio, to achieve greater capacity and enhanced stability when loaded. Merchantmen were not, however, depicted by Aegean Bronze Age artists, and the true merchantman does not appear in the pictorial record until the late sixth century BC. The date of its initial use will have been somewhat earlier, perhaps as a response to a constellation of novel conditions in the Greek world, including the opening of the Western markets as a result of the colonizing

movement, and the naval capacities of the burgeoning poleis that were able to suppress piracy sufficiently for a dedicated cargo ship with few defenses to become viable (Wedde 2002: 845).

Egyptian and Near Eastern representations record a range of forms for merchant ships (Wachsmann 1998: 9–60), but the Uluburun ship is probably typical of the merchant vessels plying the Aegean in the LBA. In view of the ship's apparent westward route and the possibility of two Mycenaean individuals aboard (Pulak 2005), the design of such Syro-Canaanite ships must have been widely known. The Uluburun ship, estimated from hull remains to have been around 15 meters long and 5 meters wide, carried a cargo weighing approximately 20 tons (Pulak 2002: 615). This 1:3 width to length ratio with its substantial storage capacity may be typical of vessels designed primarily for maritime trade in the LBA eastern Mediterranean. The smaller Gelidonya ship, estimated at 9–10 meters in length but uncertain width, has been associated with a "traveling smith, or tinker" because of the tools and scrap metal that formed much of its cargo (Bass 2005b: 51), and must represent another, poorly substantiated, class in the continuum of Bronze Age seacraft.

Neither the ships of Uluburun/Gelidonya type nor the iconographic Mycenaean galleys fit the functional end members of the round-bottomed trading ship or the oared warship, respectively. Wedde (2001: 610–12) argues for the existence of multifunctional hulls in the Bronze Age, with intermediate or hybrid forms such as the "cargo galley" or "merchant galley" developing near the end of the Bronze Age and in the Iron Age (see also Casson 1995: 65–8, 157–68). There must have been many intermediate designs that constituted distinct solutions to competing desires for increased storage capacity, speed, and ideal propulsion methods (oar or sail). As compromises, these versatile ships could be called upon for speedy transport of warriors and other important persons, time-sensitive messages, or cargo in need of rapid delivery, perhaps including perishable commodities. The Akrotiri fresco illustrates several distinct classes of craft that form a baseline for reconstructing the variety of Mycenaean ships and boats (see below).

The pictorial corpus of Mycenaean seacraft is instead dominated by oared galleys with long, narrow hulls designed to maximize the number of rowers for the purpose of high speed regardless of wind conditions (Wedde 2001: 609). Although the galley carried a mast and sail, it was a less efficient sailing ship than the merchantman with a greatly reduced cargo capacity. Pictorial vases of LH IIIC from Kynos on the coast of East Lokris in central Greece clearly show galleys engaged in naval warfare (Dakoronia 1999, 2002), and the pedigree of Aegean ships involved in warfare or piracy can be traced back at least to MH II with the painted representation on a pithos sherd from Kolonna on Aigina of armed figures aboard a ship with a curved hull (W511; Fig. 3.10), if not earlier (Höckmann 2001). The Mycenaean galley was not strictly a dedicated warship,

3.10 MH II sherd showing armed figures aboard a ship, Kolonna. Drawing by Felice Ford after Siedentopf 1991: pl. 38.162.

however, since it is frequently shown without warriors and in contexts that imply ritual and other nonmilitary activities. The true warships of Archaic and Classical Greece were the result of a gradual evolution that began with the Mycenaean galley, with incremental innovations that moved the design toward the single purpose of naval warfare.

Development of the Mycenaean Galley

The oared galley is, practically speaking, the only type of distinctly Mycenaean vessel in the pictorial record. Mycenaean merchantmen may have existed, and small working boats certainly did, but we have no indisputable representations of either. Even the Mycenaean oared galley does not appear iconographically until LH IIIB, before being depicted much more frequently in LH IIIC, leaving a period of several hundred years in Early Mycenaean and early palatial times with almost no evidence of seafaring on the Greek mainland. Because Minoan-style vessels continue to be depicted in small numbers until LM/LH IIIB, it is possible to bridge the gap by assuming that Minoan-style vessels were used by the Mycenaeans up to and including a short period of coexistence in LH IIIB (Wedde 2002: 844–45), but the examples of Minoan-style ships and boats are few on the mainland. A terracotta model from Tanagra (W319) of LH IIIA–B date that shares formal characteristics with Theran and Minoan ship images is perhaps representative of a mainland type influenced by Minoan shipbuilding traditions. Certainly, given the heavy influence of Minoan Crete on the emergence of complex society on the mainland in the Shaft Grave Era, also the time of greatest Minoan maritime expansion in the neopalatial period, such a transfer of technology would be unsurprising. On the other hand, because a Mycenaean figural tradition did not emerge in any medium until mature palatial times,

the lacuna may be simply part of the general situation with respect to artistic representation, and not an indication that seafaring was of little importance to Mycenaean polities or that Mycenaean shipbuilders lacked their own distinctive practices.

Here it is appropriate to mention the recent discovery of ships in frescoes from two sites in Messenia that help to bridge the chronological and typological gap between the ships of the Flotilla Fresco and the LH IIIC galley images. These important and as yet unpublished finds, from Pylos (Brecoulaki et al. 2011; Stocker and Davis 2011)[10] and Iklaina (Cosmopoulos 2011),[11] may prove to be intermediate types along this evolutionary path, although it is important to remember that artistic representations may not reflect actual shipbuilding traditions. The Pylos "naval fresco" as reconstructed to date shows three ships in fragmentary state (and possibly the steering oar of a fourth?) that are quite varied in their shape and appearance. What is perhaps most striking is that two of the three ships have the strongly crescentic shape of the Minoan/Cycladic tradition, while the profile of the third is flatter and curves only as it rises to the (apparent) sternpost. The hull of the best-preserved ship is brightly painted with a multicolored zigzag pattern, and three oars extend over the side of the ship into the water. At the stern an ikrion can be discerned, as well as a large foliate steering oar, with two secondary steering oars, one to port and the other to starboard. Only a small fragment of the second crescentic boat is preserved, but two oars are in the water and a steering oar is visible. The third ship seems to have an awning structure and an ikrion. The single fresco fragment from Iklaina shows a portion of a boat with two rowers under an awning structure with their oars in the water. Behind them, the head of a figure is visible behind a curved sheet that must represent an ikrion built into the awning structure. The side of the hull is decorated with painted spirals, and two dolphins swim alongside. Like the third ship in the Pylos fresco, the shape of the hull is flatter, with a gentle curve toward the prow, which is not preserved. Interestingly, the rowers appear to be backing the boat, stern-first, into anchorage.

The early date of the Iklaina fresco fragment, recovered in a reportedly secure LH IIB–IIIA1 context, makes it unique in shedding light on the transmission and adaptation of the Aegean tradition on the mainland. Michael Cosmopoulos identifies both mainland and Minoan features in the fragment, and concludes that it shows a Helladic adaptation of Minoan iconographic motifs. A significant difference between the earlier Minoan/Cycladic tradition and the later LH IIIC representations of the Mycenaean galley is that in the former, rowers are often painted realistically as men, as in the Flotilla Fresco and the Iklaina fragment, with realistic details of the hair, face, arms, and clothing. In LH IIIC rowers are schematic shapes if they are depicted at all; often the oars stand in for the men. No rowers are preserved in the Pylos fresco thus far, but the ships also blend

mainland and Minoan/Cycladic features at a much later date in LH IIIB, testifying to the continuing influence of the Minoan iconographic tradition. It is not certain whether these two examples represent a peculiarly Messenian tradition, or one that was more widespread on the mainland but rarely preserved. In any case, these frescoes do not contradict Wedde's conjecture that Minoan-style vessels were used on the mainland in the LBA and coexisted for a time with the newly developing galley in LH IIIB.

According to Wedde (2005: 29), the Mycenaeans invented the oared galley, a radical departure in naval architecture, sometime after 1400 BC. The Mycenaean galley of LH IIIB and IIIC differed in important respects from the Cycladic and Minoan ships that preceded it. Minoan ships, including the seacraft depicted in the Akrotiri Flotilla Fresco, appear to have developed gradually out of the Early Cycladic II longboat tradition illustrated in the ceramic "frying pans," two lead plaques from Naxos, a sherd from Orchomenos, and a model from Palaikastro (Wedde 2001: 610, 2006: 256 [types II–IV]). Wedde (2005: 30) argues for a single, multifunctional hull type depicted on Minoan seals and the Akrotiri fresco, one equally capable of carrying trade goods, ferrying people on religious processions, or transporting warriors. He considers this a definitively Minoan type of "oared sailing ship" because although they had crews of oarsmen, their design was primarily for sailing. They were versatile in that a small crew could operate them if room was needed for cargo storage, but they also performed efficiently as naval ships.

When representations of Mycenaean galleys appeared rather abruptly in LH IIIB on pictorial pottery, they presented a radically different hull configuration, possibly redesigned from the keel up, rather than the result of a gradual evolution (Wedde 2005: 30–32, 2006: 257–61). The Mycenaean galley loses the crescent shape and sweeping extremities of the Akrotiri ships, replaced instead by vertical stern- and stemposts. The stempost usually rises higher, and is surmounted by a bird or bird head device, in some cases realistic and in others abstract.[12] The fundamental transformation was from Minoan oared sailing vessel to Mycenaean rowed galley. Minoan-style hulls, including the Akrotiri ships stripped of their ceremonial add-ons and with sails restored, sailed efficiently while resorting to oar power mainly when compelled by environmental conditions – dead calm seas, entering or leaving harbors, rounding headlands, or avoiding lee shores. Their general-purpose shape was not optimized for any one task such as rapid movement of troops or other personnel, raiding or defending, or maximum cargo capacity, but they could modify their configuration or propulsion method as the situation demanded (McGrail 2001: 121–22).

The Mycenaean galley moved toward a more purpose-built design. Although equipped with a mast and sail, it featured a long, narrow hull that emphasized oar-driven speed at the expense of wind power and storage capacity. Some basic structural characteristics can be distilled from pictorial representations

Table 3.1. Calculated dimensions of a large ship in the Akrotiri Flotilla Fresco (after McGrail 2001: table 4.2)

Author	Beam	Length	Beam/Length ratio
Gifford	2.6	17.6	1:6.77
Gillmer	3.7	24.0	1:6.49
Toby	2.2	34.0	1:15.45
Giesecke	4.0	35.0	1:8.75

and models of LH IIIB and IIIC (Wachsmann 1998: 130–53). Along the length of the extended hull, a frequently occurring ladder-like painted design represents an open rowers' gallery with vertical stanchions defining each rower's station (see Fig. 3.3). Oars corresponding to these stations are usually visible against and below the hull, and in rare cases the oarsmen themselves are added. The origin of the penteconter (50-oared galley) in the Mycenaean galley is confirmed by the common occurrence of 25 rowing stations and oars, with slight variations in the number probably the result of artistic license or insufficient space. Thirty-oared galleys (triaconters) are also depicted, and 10- and 20-oared vessels may have been standard types as well.

A logical measure of the contrast in shape between the Minoan all-purpose hull and the later Mycenaean galley ought to be the width to length ratio, but the estimation of this ratio from two-dimensional representations presents many potential errors in both dimensions (Wedde 2000: 101–10). If paddlers, rowers, or oars are depicted, a rough length can be calculated by recourse to the *interscalmium*, or distance required between rowers or paddlers for them to execute their task. Once the length for this "motor section" is derived, the length of the bow and stern sections can be established as percentages of the depicted length of the motor section. Estimates of width (or beam) are less reliable, since two-dimensional representations provide no information. They are conventionally derived from some combination of the width required to accommodate two rowers or paddlers across, general considerations of hydrodynamic properties and shipbuilding traditions, and Bronze Age boat models.

The difficulties with this approach are easily illustrated by the widely divergent dimensions calculated for the length and beam of one of the large ships in the Akrotiri fresco (Table 3.1). With length and beam varying by as much as a factor of two, these calculations reconstruct vessels of very different size, hull shape, technical performance at sea, and likely function. It is overly optimistic to hope that Bronze Age artists sought to produce drawings at standard scales, and lacking the dimension of width, definitive reconstructions are practically impossible to generate based solely on two-dimensional images (McGrail 2001: 120). The boat models present the third dimension of beam, but are considered unreliable for calculating dimensions of real vessels because of their typically

crude execution. Interestingly, however, the beam to length ratio of most models hovers in the range of 1:3. Such a ratio implies a different kind of craft than the large Akrotiri ships, the Early Cycladic longboats (perhaps circa 1:10), or the Mycenaean and later galleys (in the 1:7 or 1:8 range), but roughly matches the ratio of the Uluburun ship. There is reason to believe, therefore, that some boat models represent cargo hulls of the day, though they could equally represent small boats, similar at least in size to those illustrated at Akrotiri. By and large, the models do not seem to depict galleys.

The Mycenaean galley offered certain performance advantages over the Minoan oared sailing vessel. It was a speedier ship with its long, narrow profile and emphasis on propulsion from the motor section and greater proportional waterline length. Although lighter overall, it seated more rowers. Being lighter, it was easier to draw out of the water onto anchorages lacking offshore mooring. It was less dependent on favorable winds, but in many situations ship captains would have preferred to wait out favorable winds rather than try to row long distances. The steering mechanism was a significant improvement: the Mycenaean triangular steering oar, evolved from its Minoan spindle-shaped counterpart, was a forerunner of the Early Iron Age to Archaic steering oar, with possibly superior hydrodynamic properties.

The drawbacks to the galley design are that it could not easily be operated with a skeleton crew (Wedde 2005: 32); its cargo capacity was reduced – a long, narrow vessel with most room taken up by oarsmen would not have made an efficient trading vessel; it was less efficient at sailing; and crew fatigue on long journeys must have played a greater role.

If the Mycenaean galley was a purpose-built ship, what were the roles for which it was designed? To answer this question, we must begin with the historical circumstances of the Mycenaean period, and consider what need there would have been for a fast seagoing ship with a large, potentially heavily armed crew and relatively little cargo space. This was an era of intensive trade and diplomatic relations among the greater and lesser powers of the eastern Mediterranean. Although the Mycenaeans may have been largely peripheral to the main sphere of interaction to the east, their presence – direct or indirect – is attested by the large quantities of fineware pottery vessels that arrived in Egypt, the Syro-Canaanite coast, and Cyprus in the fourteenth and thirteenth centuries, corresponding to pottery phases LH IIIA and LH IIIB (see Chapter 2). There is reasonable doubt about whether the pottery was carried by Mycenaean ships to all these destinations, and it seems unlikely in any case that the galley would have been an effective means to transport such commodities, except in modest quantities that make little pure economic sense. Perhaps galleys participated in quasi-diplomatic or gift exchange missions, which might result, for example, in the kind of concentration of Mycenaean pottery seen at Tell el-Amarna during the reign of Akhenaten in the mid-fourteenth century.

There is ample evidence, both direct and indirect, that piracy and naval warfare were concerns that contributed to the design of the Mycenaean galley. Already in the middle to late third millennium BC, heavily fortified coastal settlements had appeared on the Aegean islands and the Aegean coastlines of the Greek mainland and western Asia Minor. Weapons, including daggers of copper and bronze as well as sling stones, have been recovered from some of the fortified sites, and the Cycladic longboat has been linked to the implicit hostilities as a raiding ship (Branigan 1999; Doumas 1990). Later in MH II, armed figures are depicted aboard a long-oared vessel on a pithos sherd from Kolonna on Aigina Island (Fig. 3.10). This is fitting, since Kolonna was a sea power surpassed only by Minoan Crete in the MBA Aegean area (see Chapter 7). Mycenae's great period of awakening, the Shaft Grave Era, occurred in MH III–early LH IIA. The frequent martial themes illustrated on artifacts of the Shaft Graves form a striking contrast to previous Aegean imagery, and at least one object, the Silver Siege Rhyton from Shaft Grave IV, depicts a seaborne attack upon a fortified coastal settlement (Fig. 3.11). The narrative scene on the north wall of West House, Room 5 at Akrotiri, contemporary with the Shaft Grave Era in full flower, is interpreted by some as a seaside battle involving both naval warfare and seaborne attacks on a coastal town (Warren 1979: 117–18). Others prefer to see it as a shipwreck scene (Morgan Brown 1978).

Although ships of the palatial period, LH IIIA–IIIB, are poorly represented iconographically, contemporary texts and archaeological sites record Mycenaean maritime forays to the east. By the late fifteenth century, Mycenaean emigrants were active in southwestern Asia Minor and the islands of the southeastern Aegean, where their settlements succeeded Minoan colonies at Miletos on the Anatolian mainland and at Ialysos on Rhodes. In the Hittite texts from Hattusa, ships of Ahhiyawa (Mycenaeans) are reported in various actions on the sea in the fourteenth and thirteenth centuries (see Chapter 2). The Mycenaean ships that participated in a naval raid on Cyprus and helped fugitives from Hittite justice escape by sea from Asia Minor must have been galleys (Bryce 2005; Neimeier 2003). On the other hand, an apparent Hittite embargo designed to prevent Mycenaean ships from reaching the Syrian coast in the late thirteenth century (Cline 1991; Güterbock 1983: 136) may have targeted either military or commercial traffic, including Mycenaean merchant hulls if they did exist.

A small corpus of Linear B tablets from Pylos, dating to the final days of the palace's existence circa 1200 BC, concern the deployment of rowers to man ships around the coastlines of the kingdom (particularly, tablets An 1, An 610, and An 724: Chadwick 1994: 173–79). The close match between the different crew sizes that can be estimated from iconographic representations (with 20, 30, and 50 as units) and the requisition in Pylos tablet An 610 of approximately 600 rowers,

3.11 Fragment of the "Silver Siege Rhyton" showing a seaborne assault on a fortified coastal town. Mycenae, Grave Circle A, Shaft Grave IV. National Archaeological Museum 481.

a multiple of any of these apparently standard galley types, makes it reasonably certain that the ships in question were galleys, and that the palace was able to control the fleet and the personnel to operate it. The role or mission of the ships listed in these tablets is not known, but the description "Thus the watchers are guarding the coastal region" (PY tablets An 657, 654, 519, 656, 661) has been interpreted, in view of the impending destruction of the palace, as indicating an anxious effort to defend the kingdom against imminent attack from the sea (Chadwick 1994: 173–75). At the very least these recruitments involve naval or military operations rather than trade. On the other hand, the rowers are called up according to their villages of residence using the same system of proportional ratios employed for taxation, with sailors obliged to contribute service in return for land grants (Killen 1983). It is thus possible that the recruitment of rowers in Pylos tablets An 1, An 610, and An 724 represents a regular, annual activity and not a desperate measure taken at a time of extreme danger (Palaima 1991: 285–86). Most normal palatial activities continued to the very end, including craft and industrial activities, sacrifices and feasting, and the routine oversight and documentation of many aspects of the agricultural economy (Shelmerdine 2001: 351–62).

Representations of Mycenaean galleys increase dramatically in LH IIIC, ironically perhaps because of the collapse of the palaces. It is at that time that we first see the galley depicted explicitly in scenes of naval warfare, on pictorial pottery from Kynos in East Lokris (Dakoronia 1999, 2002, 2006; Fig. 3.12). The Kynos ships in particular have been compared with the roughly contemporary depictions of Sea Peoples' ships at Medinet Habu, and the similarities have been cited as evidence of a significant Aegean component among the Sea Peoples (Wachsmann 1997, 1998: 171–72). This close relationship has been disputed,

however. Seán McGrail (2001: 125) finds closer parallels for the Sea Peoples' vessels with Levantine ships, while Vassilis Petrakis (2004: 3–4) characterizes similarities such as the bird-head device as imprecise, emphasizing instead the differences in bow and stern morphology to suggest that the vessels may be of an entirely different type. Thus, ship iconography lends little weight to the assertion, better left to other forms of evidence, that Aegean refugees formed part of the movements of the Sea Peoples and participated in their raids.

It is worth asking whether the galleys and warriors engaged in combat on the Kynos vessels are meant to show pitched sea battles between the navies of two polities, or instead the predatory actions of pirates. Piracy, in the form of quick-strike raids on coastal towns, was probably a fixture of Aegean existence at least since EH II, when fortified coastal settlements became widespread. It has been remarked that there is a fine line between trading and raiding, and the same can be said for the distinction between piracy – "informal warfare" – and interpolity warfare on the seas. The Near Eastern and Egyptian documents of the LBA are replete with references to coastal raids by a variety of agents, orchestrated both by recognizable political entities (such as Ahhiyawa) and shadowy, stateless groups such as the Sea Peoples. From the perspective of modern world history, quick-strike guerilla campaigns and terrorist actions of elusive, nonstate groups pose particular problems for large states, because traditional diplomatic and military solutions tend to be ineffective. It is easy to comprehend why piracy, a form of guerilla warfare by sea, was of such concern to eastern Mediterranean states of the Bronze Age that preferred to settle their differences through diplomatic channels or traditional land battles. They were not easily able to respond in a timely or effective manner to piratical attacks, as is abundantly clear in the Hittites' protracted troubles at the hands of the renegade actor Piyamaradu, or Ugaritic texts from the Rap'anu archive containing desperate communications from the king of Ugarit to his counterpart in Alashiya (Cyprus) regarding devastating coastal raids perpetrated by unnamed enemies:

> My father, behold, the enemy's ships came
> (here); my cities (?) were burned, and they
> did evil things in my country. Does not my
> father know that all my troops and chariots (?)
> are in the Hittite country, and all my ships
> are in the land of Lycia? . . . Thus, the country
> is abandoned to itself. May my father know it:
> the seven ships of the enemy that came here inflicted much damage upon us.
>
> (RS 20.238, transl. M. Astour [1965: 255])

The responses of states to piracy could include organized and aggressive pursuit – the systematic sweeping of pirates from the seas attributed by Thucydides

3.12 Kynos A galley with decked hull, LH IIIC Middle. Wedde 2000: Catalogue 6003, after Dakoronia 1990: 122, fig. 2. Courtesy of Michael Wedde.

to the Minoans, or the historically attested Roman efforts to extinguish piracy in the Mediterranean during the *pax Romana* – and/or enhanced defensive capabilities. Defensive strategies might involve fortified harbors, coastal installations such as watchtowers for monitoring the sea and sending fire signals, placement of major settlements some distance inland, strategic deployment of naval fleets, and improved intelligence operations.

Historical texts of the post-Bronze Age period portray piracy as not only ubiquitous, but in certain contexts a not dishonorable profession. Thucydides (1.4) famously attributed to King Minos of Crete the organization of the first navy in the Hellenic world, with which he extended his rule over the Aegean and eliminated piracy therein. This passage is fundamental to the highly controversial notion of a Minoan thalassocracy in the Middle and early Late Bronze Age, but it also reflects increasingly negative attitudes toward piracy in the Classical period, a time in which unfettered trade and communication by sea were vital to highly developed state societies. At an earlier time reflected in the Homeric epics, however, the piratical life was imbued with much greater ambiguity. The practices of piracy and warfare, as well as those who practiced them, were poorly differentiated; both (as we would distinguish them) were aspects of the violent life of a seagoing warrior (de Souza 2000: 16–19).[13] In the *Odyssey*, pirates can be viewed with suspicion as "reckless wanderers of the sea . . . who risk their lives to prey on other men" (3.71–74; also 9.252–55), but the acquisition of booty through plunder is also an honorable means to achieve high status. Odysseus' false tale of a Cretan upbringing (14.191–265) includes episodes of plunder that bring him wealth and respect, and in this passage it is particularly difficult to distinguish warfare from piracy. Ultimately, however, Odysseus' Cretan adventurer is taken prisoner in a botched raid on Egyptian shores. Two further stories in Book 9 find Odysseus' ships raiding coastal settlements on their return from the Trojan War, with similar results. Upon their departure from Troy, the convoy was blown northwest to the Aegean coast of Thrace, where they attacked Ismaros, a town of the Ciconian Thracians (9.39–61). After killing the men and carrying off their wives, livestock, and other wealth, Odysseus'

men lingered, feasting in spite of Odysseus' entreaties to return to the ships. The surviving Cicones rallied local forces and routed the attackers, killing many and driving the rest to the sea. Later, it was Odysseus himself who foolishly insisted on staying on to explore the island of the Cyclopes, with the result that many of his men lost their lives in Polyphemus' cave (9.172–402). Almost comically, each of these stories ends in disaster because in their lust for booty, Odysseus and his men ignore the cardinal rule of piracy: strike quickly and get out fast. The piratical way of life is revealed as dangerous, but this level of ineptitude suggests that the Trojan War heroes turned to plundering coastal towns out of need, not by choice, and with little experience of the art.

The galley, whether in Mycenaean or later Homeric form, was the ideal pirate ship: light enough to be beached, optimized for speed with its powerful motor section and capable of rapid strike and retreat regardless of wind conditions, battle-ready with a large number of oarsmen doubling as warriors, and endowed with sufficient storage space for modest quantities of plunder to be distributed among the convoy. The typical pattern of piratical raids, whether described in LBA diplomatic letters or Homeric epics, is that when they are executed in quick-strike fashion, few towns or even empires are able to respond quickly enough to prevent attackers from escaping with their loot (Bradford 2007: 4–5).

Although the Mycenaean galley began a movement away from the all-purpose design, it nevertheless assumed a variety of roles, some of them similar to those inferred for Cycladic longboats of a millennium earlier: raiding, trading of low-bulk cargo, and elite voyaging (Broodbank 2000: 100). To these we might add rapid transport of personnel and messages, defensive deployment against pirates and enemy navies, and ultimately pitched naval battles like the ones depicted on the Kynos sherds. The apparent shift toward more frequent use in warlike situations is not surprising in light of textual and pictorial evidence from the eastern Mediterranean recording naval warfare as a relatively common aspect of LBA interrelations.

Social and Historical Impact of the Galley

Iconographic representations of the Mycenaean galley are virtually absent until the mature palatial phase of LH IIIB, but since the Mycenaean world had experienced tremendous growth economically and politically by LH IIIA2 – including the emergence of palaces at Mycenae, Tiryns, Thebes, and Pylos – there is reason to believe that the galley was part of this transformation. One motivation for the galley design may have been to extend the range of maritime forays in search of raw materials and trade contacts. The rapid development of the galley could be explained in terms of a feedback loop between a dramatic increase in overseas interaction in LH IIIA2–IIIB1 on the one hand, and innovations in technology on the other (Wedde 2005: 29). As social and economic conditions gave

impetus to technological development, the enhanced galley in turn expanded the Mycenaean world. That these circumstances may not have resulted in the development of the merchantman, as would seem logical from an economic perspective, must indicate the high priority for a ship able to defend itself and make headway under widely varying wind and current conditions.

The fact that so much of the pictorial evidence comes from LH IIIC is a striking detail that has received insufficient attention. Why the concentration of galley iconography in the postpalatial period, when it might have been expected to peak instead in LH IIIA2–IIIB1, the heyday of Mycenaean overseas contacts and international trade? Was it merely the sluggish development of a palatial pictorial/figural tradition that delayed the depiction of prominent objects already well established in daily life, or was there something particular about the relationship between the palaces and the seagoing fleets that made such illustration inappropriate?

In pursuit of answers to these questions, it is interesting to speculate on the role of the galleys in the final, turbulent years of the Mycenaean palace system in LH IIIB2. They may have had a dual, paradoxical effect: prolonging the life of declining palace centers by securing lifelines to sources of supply, while at the same time fostering the rise of maritime communities that may have contributed to the downfall of palaces if alternative power centers materialized at coastal nodes in the periphery of the palaces. The latter possibility refers to Wedde's (2005: 33–6) suggestion that a "galley subculture" emerged where galleys were built and beached, and where captains and crews lived, because galley rowing led to the formation of teams commanded by a captain and a helmsman. These became embryonic power centers. So long as the palaces were able to maintain loyalty and order by distributing benefits to key individuals and groups within the kingdom, they could manage maritime activities and the crews that carried them out. But severe disturbances beginning in the mid-thirteenth century seem to have been accompanied by disruptions in long-distance trade. Whether or not these disruptions were at least in part external and systemic to the eastern Mediterranean in general, any breakdown in the flow of goods and services to and from the palaces had the potential to strain or sever the relationships that buttressed palatial power. If nascent maritime communities existed, they may have transformed themselves from agents working in the palatial interest to dangerous male populations capable of using their specialized knowledge and access to distant sources of supply to create alternative centers of power. Closed maritime communities are known throughout history in all areas of the world; at times, they become alternative quasi-societies with their own distinctive ideologies, practices, and social structures (Adams 2001: 304–306; Muckelroy 1978: 221–5, 240–42).

The implication of this argument is that in Messenia, these groups may have helped to bring down the palace. Wedde points to rowers' coastal towns

mentioned in the Pylos tablets as possible bases, but if so they were short lived: after 1200 Messenia was nearly depopulated, so no putative coastal power centers survived the palatial collapse, casting doubt on Wedde's scenario for Messenia or any other palatial territory. The palace was clearly involved in building (Vn 46, Vn 879) and staffing (An 610, An 724) ships. The fact that the Pylos tablets belong to a period of no more than one year, and perhaps even less, prior to the final destruction and abandonment of the site implies that the palace was able to summon military personnel up to the very end, unless we propose that the rowers never reported, or that the absent rowers in An 724 were defectors. In the final days, much of the normal business of the palace continued, all recorded routinely and meticulously by palace scribes.

An alternative interpretation of the tablets concerning rowers is that they were requisitioned by the palace as part of an organized exodus of the elite in the face of impending disaster (Wachsmann 1999). The archaeological record at Pylos is plausibly read as a deliberate abandonment in which people, livestock, and valuables were removed and replaceable items such as pottery were left behind (Wachsmann 1999: 496–98). Refugees from Pylos and other Mycenaean centers fled to the east, where some settled in Cyprus and later migrants founded the Philistine cities of the southern Levant; to remote interior locations such as Arcadia; or to Greece's coasts at places like Lefkandi, Perati, and Kynos, from which maritime connections with the world beyond the Aegean would be continued or resumed. In this scenario, the galley teams become saviors who evacuated the elites instead of rivals intent on bringing the palaces down.

We now know that maritime commerce did not simply wither away after 1200 BC, but was reconfigured in the wake of dramatic social and economic transformations in the eastern Mediterranean. Many prosperous centers of LH IIIC were coastal, contradicting the once commonly held notion that Aegean communities abandoned coastal sites in fear of marauding Sea Peoples, turned their backs on overseas connections, and eked out a pastoral "Dark Age" existence. The unambiguous pictorial representation of galleys engaged in sea battles on the Kynos sherds, and the general spike in illustration of Mycenaean galleys on pottery of LH IIIC, give evidence that fleets of galleys played an important military role in postpalatial times, both to protect communities and their assets, and to serve as offensive weapons to carry out swift seaborne raids. The capability to build fleets of galleys and organize defense and overseas trade implies that some form of hierarchical society with sufficient organizational infrastructure persisted in LH IIIC. It even seems possible that galleys were one element of a revived – or preserved – elite culture, along with feasting, hunting, chariot riding, seafaring, and warfare on land and sea, which found expression on pictorial *kraters* in the Euboean Gulf area in LH IIIC Middle (Crielaard 2006: 282). Perhaps the galley warriors depicted on the Kynos sherds, and the shipbuilders and ship captains they imply, are examples of Wedde's "galley subculture," elevated to a new

level of prominence in the economic and social conditions of LH IIIC Greece, and the ancestors of Odysseus and Homer's other seafaring heroes (Wedde 2005: 36).

Returning to the original observation of concentrated depictions of galleys in LH IIIC, none of the hypotheses just cited addresses why the palaces did not invest more liberally in ship representations as expressions of their power and reach,[14] but in postpalatial times such images may have been fitting expressions for newly empowered groups focused strongly on the sea. Most of the great palace centers – Mycenae, Thebes, Pylos, Knossos – were situated inland and drew the bulk of their resources and power from fertile agropastoral hinterlands.[15] In the postpalatial era, smaller-scale polities lacked the means to control vast territories, and so may have preferred to organize into "small worlds" of settlements occupying good anchorages with modest agricultural hinterlands, relying on one another for protection and more generally for social and economic viability. Galleys and other types of seagoing craft, commanded by sea captains who now perhaps wielded the power of basileis as they do in the *Odyssey*, forged the essential links that bound these reconfigured "maritime cultural landscapes" (Westerdahl 1992). It is conceivably for these reasons that galleys became a popular subject for pictorial pottery.

Small Boats

To put it plainly, we know virtually nothing of the range of small boats the Mycenaeans used. There are no physical remains, no pictorial representations, and no textual references. This poses a problem for a central claim of the present study, that short-distance contacts constituted the main maritime interactive spheres of Mycenaean small worlds, since boats of various forms and functions should have been the workhorses that maintained these close connections. Are these craft, therefore, irrevocably lost to us? The answer is not quite, although we are left to speculate on the basis of mostly indirect evidence. The relevant classes of evidence we do possess are (1) contemporary or near-contemporary pictorial representations, such as Egyptian tomb paintings, seal engravings, and the Flotilla Fresco at Akrotiri; (2) Bronze Age boat models that may or may not represent small boats; (3) worldwide ethnographic data on "traditional" boat building and use at sea; and (4) experiments in building and navigating replicas of ancient ships derived from analysis of sources 1–3 above.[16] One factor that tends to legitimize comparison with contemporary and near-contemporary non-Aegean, as well as worldwide ethnographic, specimens is the long-term conservatism so frequently observed in form and function of small craft. Consider that the large ships of antiquity, from galleys and merchantmen to the great naval and grain ships of the Roman Empire, have all long since disappeared from use as obsolete – it would be absurd to contemplate building such craft today

except for historical interest. These ships are technology driven and frequent modifications are part of a competitive process for greater cargo capacity, more speed or superior sailing capabilities, or better defensive or offensive characteristics. By contrast, small boats similar in many respects to those depicted in the Akrotiri fresco and in Egyptian tomb paintings and models are still to be found in scattered parts of the world. This is so because throughout time they have facilitated the fulfillment of local (or "microregional") subsistence and social needs among societies under conditions that necessitate the use of low-cost, readily available materials with minimal technology including simple tools such as adzes, saws, and bowdrills of metal or stone. This has given rise to innumerable local traditions and endless variations of boat form, "conditioned by the geography of the local waters, climate, purposes for which the boat was needed, availability of materials for their construction, tradition of craftsmanship which grew up among the boatbuilders and the general state and nature of the culture of the people building them" (Greenhill and Morrison 1995: 20). Nevertheless, it comes as little surprise that a Middle Kingdom Egyptian papyrus skiff (Jones 1995: fig. 26), an Early Cycladic model canoe of hammered lead (W105), a canoe appearing in the Flotilla Fresco, and a modern dugout canoe of the Caroline (Gladwin 1970) or Solomon (Feinberg 1988) islands of the Pacific should have such similar forms as a result of comparable basic materials – including the physical properties and behavior of wood – and uses. In fact, a "papyrus" skiff (*papyrella*) remained in use on Kerkyra (Corfu) in Greece into the 1980s for local fishing and lobster trapping. (Tzalas 1995b reports that despite the colloquial term *papyrus*, the plant is actually *Ferula communis* L., the giant fennel.) Harry Tzalas remarks on the close resemblance of a reconstructed papyrella, built by a local craftsman with no knowledge of ancient boats, to the Bronze Age Egyptian skiff, attributing this to the limitations of the long-stemmed plants themselves, commenting ". . . it would have been difficult, if not impossible, to obtain a different form" (Tzalas 1995b: 446). Small-scale coastal and island societies with modest access to raw materials, manpower, and technology always require simple water transport for fishing and other subsistence activities, as well as transport within the small worlds that are defined by their social and economic networks. The basic needs of Mycenaean coastal communities were no different; thus it is reasonable to proceed with an examination of the forms of evidence enumerated above.

At the outset, we might propose a series of boat types, and identify the range of functions they may have served in LBA coastal settings (Table 3.2). If a coastal community hosted a harbor that admitted large galleys and trading ships, certain classes of small boats facilitating access in and out of the harbor would be required, especially if the water was shallow or underwater hazards necessitated the approach of larger vessels via specific channels. This kind of boat, which we might refer to as a pilot or guide, has been recognized in the

Table 3.2. Hypothetical Late Bronze Age small boat types and functions

Vessel type	Propulsion	Range	Functions
Pilot/guide	Rowed or paddled	Local/harbor	Guide incoming ships into harbor channels and away from hazards; to mooring near shore or on offshore islands
Barge	Poled or paddled	Local/harbor	Load and offload cargo
Canoe: dugout; papyrus or reed	Paddled	Local	Fishing, local travel
Rowboat	Rowed	Local/regional	Fishing, local and regional trade and social communication
Coasting vessel	Rowed or sailed	Local/regional	Regional trade and social communication

small canoe (W622) being rowed out to meet the ceremonial ships at the Arrival Town in the Flotilla Fresco; three identical canoes are beached on the shore. Another type of harbor vessel would assist in loading and unloading cargoes where ships could not approach closely to shore. The ideal form for these boats would combine storage capacity with shallow draft – most likely a smallish craft propelled by oars and maximizing beam while minimizing draft within the constraints of local conditions. Because of the often windy and turbulent conditions of Aegean coastlines, large, flat barges like those plying the Nile in the Bronze Age would not have been feasible.

Vessels specifically dedicated to subsistence needs would include boats for fishing and trapping in coastal waters and wetlands. The empirical evidence for fishing in the prehistoric Aegean is not overwhelming (Powell 1996). Judith Powell assembled the evidence from faunal remains, fishing equipment, and iconographic representation available in the mid-1990s. It is safe to say that few of the earlier archaeological investigations surveyed by Powell routinely sieved, let alone floated, archaeological deposits to recover botanical and other tiny to microscopic remains. In recent years, however, sieving and flotation have become standard practices of most Aegean projects, with the result that among the small finds recovered by this process are fish bones, fishhooks, and sinkers. As these data are incorporated into archaeological knowledge of Aegean prehistory, a more balanced assessment of the contribution of fishing to local subsistence will be possible. To cite the example of one site central to our discussion, Kynos has produced substantial numbers of fish bones, fishhooks, lead weights (for nets), and shells from edible and inedible shellfish (Dakoronia 2002: 287).

It is important to consider the range of different methods and settings for fishing, broadly defined. One meaningful way to differentiate fishing activities and their requirements is by setting (Table 3.3). Although it is difficult to avoid a measure of arbitrariness (e.g., the five-kilometer boundary between inshore and offshore fishing is arbitrary and will vary with local conditions)

Table 3.3. Range of fishing practices defined by setting (after Pickard and Bonsall 2004: 274)

Type of fishing	Setting
Land-based fishing	All fishing practices that can be conducted from land, without the use of watercraft
Inshore fishing	Fishing activities conducted using watercraft up to 5 km from shore
Offshore fishing	Fishing conducted more than 5 km from shore
Open-sea fishing	Fishing conducted out of sight of land
Deep-sea fishing	Offshore or open-sea fishing in deep waters

or to imagine that each of these categories correlates with different equipment, practices, or targeted resources, they do prompt us to contemplate fishing more broadly in terms of the comparative difficulty of exploiting different species, the methods of fishing and the required technology including boats, and the risks and rewards as one ventures further from shore.

There are many methods of land-based fishing that do not require watercraft, focused in the shallow waters just offshore or in coastal wetlands.[17] Among these are casting a fishing line from shore; fishing with hooks or spears while wading or swimming; diving for shellfish or sponges; setting traps for fish, lobsters, octopi, and other marine life in shallow wading water; and collecting crustaceans on sandy beaches (Powell 1996: 82–138; for ethnographic examples of fishing strategies, see Feinberg 1988: 22–24, 124–32; Gladwin 1970: 27–32). Wetlands provide another set of land-based activities that may involve fishing, fowling, and collecting shelled animals and amphibians.

At a distance from shore, fishing from boats can involve many of the same basic techniques – diving, spearing, fishing with nets or with hook and line – adapted to the prevailing conditions at sea. These techniques are equally practicable from dugout canoes or plank-built rowboats, though modifications such as outriggers attached to dugout canoes may be specialized adaptations for fishing or other tasks (Feinberg 1988: 51–59). Ethnographic research on island societies suggests that few engaged regularly in offshore or open-sea fishing, except under conditions of scarce terrestrial resources (Pickard and Bonsall 2004: 276); nevertheless, open-sea and deep-sea fishing are not unknown (Feinberg 1988: 23). Bones of bluefin tuna are present in Upper Mesolithic levels at Franchthi Cave on the Greek mainland, approximately 9000–8000 BP. The remains of these pelagic fish suggested deep-sea fishing already at that time (Rose 1995; Runnels 2001: 247–48), but recent assessments are more skeptical, pointing out the small quantities of the bones and the possibility that tuna could be caught by nets as they enter inshore waters to feed (Perlès 2003; Pickard and Bonsall 2004: 283).

No Linear B texts are known to refer to fish or fishermen (Palaima 1991: 284), probably meaning that fishing was not controlled directly by the palaces and thus was not part of scribal recording systems. Like clay, fish and other marine

resources were ubiquitous and it was not feasible for the palace to control access to this basic subsistence resource in coastal areas. This is not to say that the palaces took no interest in products of the sea: the palace may have had several sources of indirect supply from which to choose, as was apparently the case with pottery at Pylos (Tartaron 2008: 105–106). It merely means that the palaces did not attempt to monopolize marine resources or control their movement through the kingdom, as the Pylian palatial elite did with precious metals and the Knossian palace did with sheep. Silence in texts should not be taken to mean that marine resources were little exploited, since in the historical period a comparable paucity of references to fisherman and their products reflects their low social status in spite of ample evidence that fish were eaten and generally appreciated. The frescoes of young fisherman at Akrotiri and the frequent depiction of fish and sea life on pottery (particularly in Minoan Crete) suggest their importance. During postpalatial times, fisherman working communally to trap fish with nets were depicted on painted pottery at Kynos and Aplomata (Yasur-Landau 2010: 91–92, figs. 3.38, 3.39). On the other hand, to date stable isotope analysis of skeletons has failed to demonstrate a significant contribution of marine protein to the diet of Bronze Age individuals, even at coastal sites (Petroutsa and Manolis 2010; Triantaphyllou et al. 2008). The extent to which this result is a methodological issue of measurement remains a matter of debate (Hedges 2004), so it is not yet safe to conclude that Bronze Age coastal dwellers eschewed marine dietary resources. It will be interesting to see whether flotation of archaeological deposits in the future supports the isotopic finding of near absence of marine products in the diet.

Another type of craft plying local and regional waters would fall under the broad rubric of *coasting vessel*. The coasting vessel, or coaster, has the primary function of "sailing along or near a coast, or running between ports along a coast," typically engaged in coasting trade "carried on by water between neighboring ports of the same country, as distinguished from foreign trade or trade involving long voyages" (Webster 1913). This functional definition offers little help in imagining what such vessels would have looked like in the Aegean Bronze Age, but we might expect certain characteristics, notably shallow-hulled ships and boats that can negotiate reefs and other hazards where deeper-hulled seagoing ships cannot. Their construction could be less heavy and robust than that of ships built to withstand long voyages on the open sea, the latter perhaps best exemplified by the Uluburun wreck. Perhaps we can recognize a coasting vessel in the modest dimensions of a craft at Akrotiri (W612; Fig. 3.13), rowed out of the harbor of the Departure Town with five rowers under a (temporary?) framework, a helmsman operating a single steering oar, and a seated figure behind him at the stern. Other fragmentary boats appearing in the Flotilla Fresco (W632, 633) may be of the same class, and we might even include the lone boat under sail (W617), once the ceremonial embellishments (ikrion [?],

3.13 Ship rowed from "Departure Town," Flotilla Fresco, Akrotiri. Wedde 2000: Catalogue 612. Courtesy of Michael Wedde.

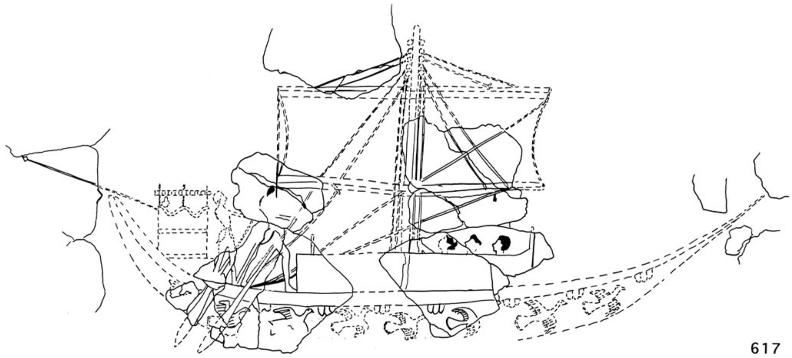
framework, hull decoration) were removed (Fig. 3.14). Coasting boats of this scale, propelled by oar and sail, are central to the notion of maritime small worlds because they played the primary role in creating and maintaining the networks that constituted them.

With these hypothetical statements about the form and function of boats operating in Mycenaean small coastal worlds, we may continue with a closer examination of the lines of evidence proposed above.

Egyptian Boats

A broad range of depictions of ships and boats has survived from Bronze Age Egypt, the result of a rich visual culture, excellent preservation even of organic material, and the fundamental place of water travel in everyday life as well as in the deeply symbolic and religious structures of the Egyptian worldview. These representations consist of tomb paintings, temple reliefs, boat models mainly from tombs, and remains of actual full-scale boats. Boat models were crafted in wood, ivory, clay, and metals including gold and silver. The vast majority of the surviving examples are of wood, hinting at an entire class of models that may have existed in the Aegean, but that will have disappeared in poor preservation conditions.

The boats found in Egyptian tombs served a range of essential functions for the deceased: utilitarian vessels provided for traveling, carrying loads, hunting and fishing, and pleasure cruising; funerary boats conveyed the mummy across the Nile for burial and on journeys to Abydos and other sacred sites; and magical boats carried pharaohs on eternal journeys to cross the sky by day and the underworld by night (Jones 1995: 27). One of the principal types of utilitarian watercraft, the use of which spans the entire Bronze Age from the Old to the New Kingdom, was a skiff built from bundles of bound papyrus plants. These utilitarian craft were used locally to carry light loads and for fishing and fowling in wetlands (Jones 1995: 36). The papyrella used until recently on Corfu, mentioned above, has a form similar to the Egyptian skiff, a result of the

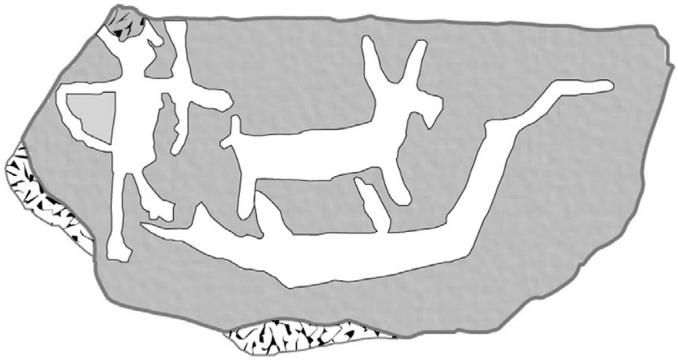


3.14 Ship under sail, Flotilla Fresco, Akrotiri. Wedde 2000: Catalogue 617. Courtesy of Michael Wedde.

comparable working properties of the papyrus and giant fennel, and was used in a comparable range of settings and for similar tasks. The simple construction of these canoes, made by lashing together bundles of cut stalks with vegetable fibers or leather strips, fulfilled the requirements of low cost and low technology for families with few resources for elaborate and expensive watercraft.

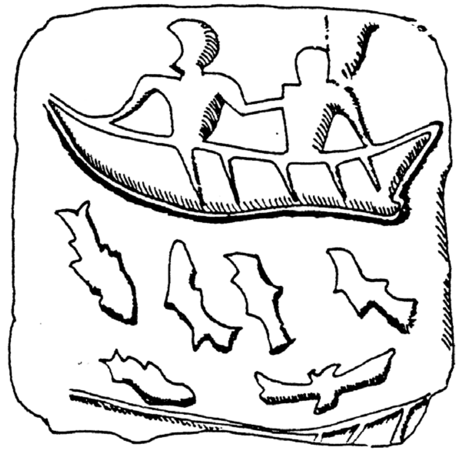
Iconographic Images of Small Boats

Apart from the four small skiffs or canoes (W622–25) from the Flotilla Fresco, there are few other Bronze Age images that can be interpreted unambiguously as realistic representations of small boats. There is a large corpus of seals and a few sealings and gold signet rings (W701–981; Wedde 2000: 331–49), almost exclusively from Crete and ranging in date from EM III to LM III with a peak in MM III–LM I, which depict boats or ships of various kinds in "cultic" or "ritual" scenes. Within this corpus several subcorpora can be distilled. One such group (W901–912; Wedde 2000: fig. 18) features anthropomorphic figures of deities or worshippers in boats along with other standard elements of Minoan cult scenes, including trees (W904) and tall structures surmounted by horns of consecration (W908). Another group comprises the so-called talismanic seals, characterized by the use of a tubular drill and broad cutting stone to create heavy geometric elements, resulting in highly abstracted motifs (Onassoglu 1985; Wedde 2000: 134–41, figs. 12–14). When ships or boats appear on talismanic seals, typically only the bow and a portion of the length of the hull are shown, along with a bird device on the bow and a highly stylized ikrion, outlined by net and lunette patterns, rising from the hull (Wedde 2000: figs. 12–14). The trouble with identifying these images of watercraft as small boats is that their dimensions often cannot be estimated on human scale if no figures are depicted, and for many we cannot rule out that the artist sought to illustrate fantastical or magical craft rather than boats faithful to real-life examples. Thus, the cultic group

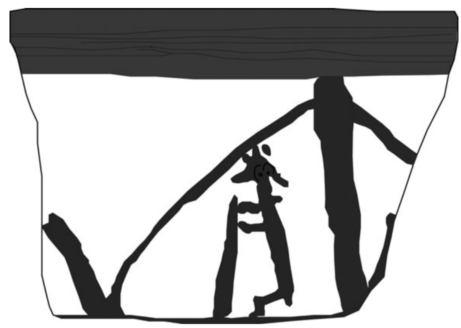


3.15 Incised image of a boat with human and animal, Korphi t'Aroniou, Naxos, Early Cycladic. After Wedde 2000: Catalogue 413.

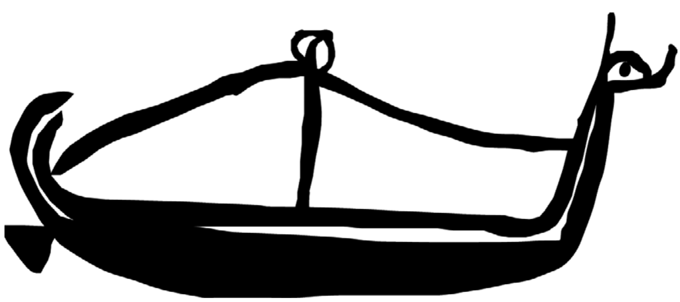
(W901–912) depicts craft carrying an individual or a small group of figures suggesting a small boat, but with the figures themselves often appearing at distinctly different scales, it is difficult to infer how large a vessel the artist imagined, if that was even an important detail at all. Consider another example, an Early Cycladic graffito cut into white marble from Korphi t'Aroniou on Naxos (W413; Fig. 3.15). This pictograph presents a narrative scene of a flat-hulled boat with a prominent rising bow, onto which a quadruped (goat?), more than half as long as the boat itself, has been loaded while a human holding implements in each hand steps onto a spur at the stern. Perhaps the intended narrative is the short-distance transport of an animal or two to grazing lands or for trading with another coastal community, but I find it equally compelling to understand this graffito as a kind of shorthand depiction of a much bigger event, such as the departure scene of an early colonizing expedition in which these figures stand in for many animals and people setting out in larger ships – for example, from the Cyclades to Ayia Photia on Crete in the EBA. In rare instances, we can be more certain that the artist intended to illustrate a small boat. A green steatite seal, found in a MM I context at the palace at Malia (W808), depicts two men occupying most of the space in a flat-hulled boat lacking a mast or other rigging, with five parallel, subvertical appendages to the hull that probably represent oars (Fig. 3.16). Below the boat, six fish swim randomly about. The iconographic elements and the minimal rendering of this scene suggest a simple fisherman's rowboat at work. Other cases are more ambiguous. For example, the lip of a Mycenaean LH IIIC pictorial krater recently excavated at Kynos preserves portions of the mast, forestay, backstay, and the extremity of either the stern or the bow of a sailing vessel (Dakoronia 2002: 286–87; Fig. 3.17). No sail is visible, but a single standing figure operates an oar, indicating the possibility of a harbor scene. Fanouria Dakoronia (2002: 287) reads the vessel as a fishing boat, pointing to similarities with the ship depicted on the LH IIIC stirrup jar from Skyros (W655), to which she ascribes a similar function (Fig. 3.18). Others have



3.16 Green steatite seal showing two men in a boat with fish swimming underneath, Malia MM I. Wedde 2000: Catalogue 808, after Van Effentere 1980: 72, fig. 98. Courtesy of Michael Wedde.



3.17 Fragmentary boat from an LH IIIC pictorial krater, Kynos. After Dakoronia 2002: 290, fig. 11.



3.18 Motif of a sailing ship from an LH IIIC stirrup jar, Skyros. Skyros Archaeological Museum A77.

not generally taken the Skyros vessel as a fishing craft, however, and this once again underscores problems of confidence in the recognition of small boats.

Boat Models

There is reason to believe that small craft are better represented among Bronze Age model boats. Wedde's catalogue lists 50 models, 9 from the EBA, 5 from the MBA, and 36 from the LBA, with the largest group in LH/LM III. Unlike iconographic images, models, as three-dimensional objects, permit measurement of beam and can be used to calculate ratios of length, width, and depth of hull, but only a small number of the models are sufficiently preserved to allow measurement of all these dimensions. The pattern, cited above, that the measurable models cluster around a 1:3 width to length ratio suggests to Wedde (2000: 108) either a class of Aegean Bronze Age boats that were beamier than two-dimensional images suggest, similar perhaps in ratio and function to the Uluburun merchant ship, or that the models depict mainly small boats.[18] In favor of the latter interpretation is the generally simple (sometimes crude) execution of the models and the lack of elaborate attachments and decorations; often a few tholes or thwarts are the only molded attachments if any are present at all. Rarely a mast step or stump is present to indicate a sailing vessel (W301, 314, 323). Some models, notably in LH/LM III, were painted with banded and other linear decoration, or in some cases even more elaborate motifs, with clear parallels in painted fineware pottery and figurines (see Figs. 2.8, 3.2). The simplicity of many models and the width to length ratios are suggestive, but not conclusive, that these models are more representative of small boats than beamy cargo ships. Because many come from the mainland as well as islands (including Crete) under Mycenaean influence in LH III, the boat models form a significant body of material to illuminate coastal interactions at regional and local scales.

Ethnographic Analogies

The benefits and dangers of using ethnographic analogy to illuminate poorly understood aspects of the distant past were discussed in Chapter 2. When considering the forms and functions of boats, it is questionable whether analogies from contexts distant in space and time or from recent and historical times in Greece will be of much help, beyond the general assertion, already made, that the technology of small boats used in local and microregional settings is more conservative and enduring than that of larger seagoing ships. A more persuasive application of ethnographic data parses the relationships between the physical and performance characteristics of a boat, the mariners who sail it, and the relationships of maritime societies with the sea and with other maritime societies. Much of this information is important explicitly because we possess no tangible

evidence to reconstruct nonmaterial aspects of Mycenaean maritime life, and ethnographic accounts provide new and diverse ways of thinking about them. The insights that can be gained from ethnographic data are taken up mainly in subsequent chapters in discussions of navigation and intersocietal interactions.

As indicated by the earlier quote from Greenhill and Morrison, local ship technology results from a complex combination of environmental and social conditions. The factors that make boats similar or different across space and time are conditioned on the one hand by the building materials, tools, and general level of technology available, and on the other hand by the tasks to be carried out in boats, which are shaped by subsistence patterns and by social needs (relationships of trade, kinship, friendship, intermarriage, etc.) within society and with people in distant locations. Because of the complex interplay of these factors, boats in societies facing similar environmental conditions and having comparable social structures may be dissimilar, while quite similar boats may be produced by societies sharing few social and environmental circumstances. The latter case is possible because certain universal factors come into play in simple boat technology. One of these concerns the widespread use of trees and plants as sources of construction material. Humans learned independently in many places that long tree trunks could be hollowed out to make dugout canoes, and long experience with the hydrodynamics of the form resulted in various modifications that responded to conditions both local and universal. In the Aegean, the dugout canoe was apparently used during the Neolithic and persisted into the EBA, attested by four hammered lead boat models from EC II Naxos (W105–108) whose forms are remarkably similar to canoes in recent Pacific island traditions. Although the Early Cycladic longboat is an apparent descendant of the dugout canoe, dugout construction was replaced by plank-built ships and boats already in the third millennium BC. As we have seen, stalks of different plants (papyrus and giant fennel) had analogous uses in Bronze Age Egypt and modern Corfu, resulting in boats of similar form and function in two vastly different social settings. One way to make sensible use of comparative data on boat form and function is to draw upon performance characteristics derived from ethnographic observation as well as experimental testing of reconstructed "ancient" boats.

Performance

The performance of a ship or boat at sea depends on multiple and interacting technical, environmental, and human factors. The technical characteristics of the vessel govern the parameters of its behavior at sea and its tolerances under a range of maritime conditions, modified by alternative configurations and loads that may change from voyage to voyage. Thus, a merchant's sailing ship, like the one that wrecked at Uluburun, will have a sharply different performance

profile from an Early Cycladic paddled longboat, quite independent of any environmental or human variables. Environmental factors include macro- or mesoscale forces such as weather and prevailing winds and currents, which in the Mediterranean are often subject to pronounced seasonality. The configuration of coastlines controls the distance between landfalls and the landing places that are suitable for different kinds of vessels; the distribution and contour of land masses in the sea influence visibility and navigational possibilities. The human dimension must take account of experience, knowledge of habitual and alternate routes, navigational knowledge and skill, and crew attributes such as technique, strength, and stamina. In the next chapter I consider in detail the environmental and human contribution to maritime travel; here I focus on what we can reconstruct of the technical performance characteristics of the different types of vessels we have proposed for the Mycenaean world.

Estimation of performance does not depend on a vessel's technical specifications alone, of course. Typically, when attempts are made to evaluate the performance of ancient ships on the basis of the technical parameters of their design, environmental and human factors are neutralized, held "constant," or "averaged." The resulting projections are usually optimized or maximum performance limits. For this reason, ethnographic reporting offers the advantage that the complete interplay of technical, environmental, and human factors can be observed and assessed, and the reasons for success or failure to achieve optimal performance can be identified. To move toward valid comparisons between Aegean Bronze Age mariners and those living in our time in the Pacific, Alaska, or elsewhere in the world, the similarities and differences in all three classes of variables must be identified and assessed. Experiments with reconstructed ancient vessels have the advantage of sailing the same seas as their ancient counterparts, potentially facing many of the same environmental conditions specific to Aegean seafaring. The challenge with these experiments is instead to reach a satisfactory level of confidence that the physical specifications, and to a lesser extent the human performance characteristics, are right.

Let us consider some published data that have been offered as baselines for vessel performance in the Aegean Bronze Age. Cyprian Broodbank (2000: 101–106, 341–48) uses ethnographic data, calculations based on ancient hull remains, and experimental archaeology with "broadly analogous boats" to carefully outline the performance implications, as well as the profound social and economic transformations that attended the transition from paddled canoes and longboats to the first sailing ships in the late third millennium BC (Table 3.4). The advent of sailing technology, probably transmitted first to Crete via contacts with Egypt, brought in train a series of new performance capabilities. The ability to harness wind power increased the speed of voyaging significantly while also making longer voyages feasible by conserving muscle power. A sailing ship could now voyage from Crete to Egypt in the four days that were previously required

Table 3.4. Optimized performance characteristics for different types of Aegean Bronze Age seacraft (adapted and expanded from Broodbank 2000: tables 3, 12)

Parameter	Small canoe	Early Cycladic longboat	Rowed or sailed galley	Uluburun wreck	Gelidonya wreck
Length	4–6 m	15–20 m+	Up to 35 m	15 m	10 m
Crew size	1–4	25+	Up to 100+ (penteconter)	Fewer than 10	Fewer than 10
Labor intensiveness	Low	High	High	High	High
Maximum speed	5 km/h	10 km/h	15/25 km/h (rowed/sailed)	25–35 km/h	25–35 km/h
Daily range	20 km	40 km	Up to 100 km (if sailed)	100 km or more	100 km or more
Overall range	Local/regional	Aegean	Long-distance	Long-distance	Long-distance
Wave tolerance	Moderate	Moderate	High	High	High
Harbor facilities	Minimal	Minimal	Sheltered harbor with sufficient draft	Sheltered harbor with sufficient draft	Sheltered harbor with sufficient draft
Cargo capacity	Minimal: 50–150 kg	Moderate: up to 1 ton as barge but low with crew	Moderate with full complement of rowers	15 tons+	>1 ton
Ethnographic use	General purpose	War canoe and high-status voyaging	War and transport galley; piracy	Merchantman	Merchantman

for a longboat to reach Crete from the mid-Cyclades (Broodbank 2000: 345).[19] This greater speed and range effectively shrank the Aegean and reconfigured maritime relationships. On Crete, the new maritime technology and the contacts it fostered with Egypt and the Eastern Mediterranean proved to be contributing factors to the rise of complex society and ultimately to the emergence of palaces and their elites, who exerted strong cultural and even political influence over the Cycladic islands in the first half of the second millennium BC.

The sail made new sea routes possible by allowing the ship to make considerable headway against the wind (Broodbank 2000: 345–46), though it remains controversial just how well they did so, and how often voyages of any length were taken against the wind (Tilley 1999). In this regard, nevertheless, the sailing ship was clearly superior to the galley in offering possibilities for sailing to windward.[20] With their limited sailing ability, galleys had recourse only to short bursts of exhausting rowing to advance into the wind. The implications of this limitation for sea voyaging are worthy of consideration. In a later period, Viking galleys served admirably in roles requiring speed, rapid deployment and escape, and transport of warriors. But as long-distance, open-sea sailing vessels, Alec Tilley (1999: 424) comments, "Wonderful though their galleys

were, they made a long ocean voyage an adventure for heroes, not a profitable venture for merchants." The situation for Mycenaean galleys must have been similar, even in the smaller world of the Aegean. Their movements must have involved coast-hopping with frequent stops, making long open-sea crossings only in the expectation of favorable winds. Still, we are left with a curious lack of evidence for true Mycenaean sailing ships capable of voyaging throughout the Mediterranean as merchant vessels.

Historical records indicate that in antiquity, ship captains often preferred to wait out fair winds rather than risk sailing to windward for extended portions of a journey. Sailors possessed techniques for advancing against headwinds, but progress was often slow and the effort arduous. In the early 1970s, ethnographer Richard Feinberg accompanied a sailing canoe on a 50-kilometer voyage, into the wind, from Anuta to Patutaka in the Solomon Islands (Feinberg 1988: 89–91, 133–47, fig. 19). The navigator's technique was to take a favorable tack as far as possible under sail, then lower the sail and paddle back to the point where the initial tack could be resumed, marking out a zigzag path. Using this slow, strenuous process, the voyage took twenty hours. The trip home, running under a brisk wind, took only six.

The challenge presented by headwinds in the era before the sail appeared in the Aegean would have been that much greater, as the experiments conducted with the Corfiot papyrella illustrate (Tzalas 1995b; Fig. 3.19). Tzalas' point of departure was to evaluate the hypothesis that the obsidian that found its way from Melos to Franchthi Cave already in the Mesolithic period was transported on paddled reed boats, similar to those used in Egypt in the Bronze Age and in use until recently in Corfu, making the long voyage in a series of coastwise and open-sea segments. After resolving problems with construction techniques and recruitment of a five-person paddling crew, the team wished to set out from near Franchthi, only to discover that the circumnavigation of the Saronic Gulf would be so long and arduous as to give no advantage over acquisition through overland transport from a coastal anchorage much closer to Melos. The team subsequently chose to begin the voyage at Lavrion in Attica. This finding in itself deserves comment. In recent decades, it has become commonplace among Mediterranean archaeologists and historians (myself included) to assert that under conditions of ready access to the sea and underdeveloped terrestrial infrastructure, travel by sea would have been a more efficient and less arduous means of maintaining contacts with other coastal and near-coastal communities near and far. As a counterbalance to the land-focused reality in which most modern Western scholars live, this "corrective" has had some validity and utility. Yet the pendulum may have swung too far, such that the difficulties of sea travel are now underestimated, and long histories of overland connectivity disregarded. Still, Tzalas' claim that a coast-hugging voyage from Franchthi to Melos circumnavigating the Saronic Gulf "would have required much more

3.19 Experimental Corfiot papyrella on the Aegean sea. The Papyrella Voyage is a project of the Hellenic Institute for the Preservation of Nautical Traditions. Courtesy of the photo archive of Theodor Troev.

time than the combination of a land voyage from the Argolis to Attica and a sea crossing from Lavrion to Melos" (Tzalas 1995b: 450) is jarring, since we would normally regard the overland journey from Lavrion to Franchthi as particularly long and difficult. Part of the solution may lie in a number of coastal nodes, lost in the rise of global sea level since the Mesolithic, through which obsidian may have been exchanged in down-the-line fashion. It should be remembered that obsidian was recovered in only miniscule quantities from Mesolithic levels at Franchthi (Perlès 1990), making the notion of direct Franchthi to Melos runs all the more unlikely. If such intermediate settlements did exist, obsidian distribution would have entailed a series of short-distance trade expeditions by land or sea, a very different scenario. In the bigger picture, assertions such as these that run counter to current ways of thinking challenge us to develop more precise knowledge about how exchange worked at diverse scales, including the role of overland traffic.

As the papyrella made its way from Lavrion to Melos in early October, with two or three island stops scheduled, it encountered unseasonably (though not extraordinarily) rough weather, including heavy rain, high winds, and waves of 1.2–1.5 meters in height. As a result, in addition to seven days of paddling at sea, another eight days were spent anchored at Seriphos when severe weather and winds of 7 and 8 Beaufort made conditions at sea too dangerous. Thus, a relatively modest sea voyage of 120 kilometers might consume an entire

month – or more, since the return voyage would face opposing sea currents and a greater chance of headwinds.[21]

The adverse environmental conditions proved to be a blessing in disguise, because they tested the design and addressed the research question in a way that perfect weather and a trouble-free voyage could not. The general seaworthiness of the Corfiot boat proved that the simplest kinds of vessels constructed with basic, universally available tools and materials were capable of island-hopping voyages in the Aegean. The technical and environmental problems encountered en route illustrate vividly some of the challenges the Aegean presents for small-boat captains.

By harnessing wind power, sailing ships reduced the need for human propulsion, allowing for smaller crews and increased cargo space. Merchant vessels of the LBA, of which the Uluburun ship is perhaps representative, improved sailing capabilities and cargo capacity while sacrificing speed and the ability to operate in shallow anchorages. As we have seen, the design of the Mycenaean galley moved in the opposite direction toward a fast rowing ship that maximized crew at the expense of storage and sailing capability.

Broodbank (2000: 346–47) indicates some important implications of the arrival of the sailing ship for coastal inhabitants. The increased speed, range, and cargo space triggered the establishment of new maritime networks as any particular place on the Aegean coast could now be reached more often, and from much more distant points of origin. The Aegean became smaller and contacts expanded. With greater range and cargo capacity, the transport of perishable bulk staples became feasible over longer distances, presenting an opportunity for small coastal communities, for whom self-sufficiency and highly localized subsistence networks had been a matter of survival, to expand into larger, nucleated settlements sustained by regional-scale exchange networks.

The transition from canoes and other light boats with minimal draft to broader, more heavily laden ships propelled primarily by wind power also meant that many shallow and/or exposed beachfronts could not accommodate the new ships. Sailing ships, with heavy sails, rigging, and cargo, could not be dragged out of the water, instead requiring anchoring or mooring in sufficiently deep water off the coast; nor could they easily get underway against strong winds. The result of these new requirements was a partial shift from the opportunistic use of a proliferation of small anchorages to the establishment of major dedicated harbors at the more limited number of suitably sheltered, deep-water anchorages that the Aegean offers.

The archaeological record of the Cyclades in EC III–MC I is plausibly interpreted to manifest these transformations. Old island centers lacking sheltered anchorages, such as Chalandriani-Kastri on Syros, declined while new nucleated settlements with excellent harbors (Akrotiri, Phylakopi, Paroikia on Greater

Paros) grew and flourished (Broodbank 2000: 347–49). External influences, particularly from the emerging powers on Crete, expanded interaction spheres in the Aegean. Although Broodbank emphasizes the nucleation of settlement and maritime activity around the sheltered harbors once sailing ships were in place, I think it is important to assert that small boats and anchorages would not have disappeared from use. Although the configuration of many networks changed, with old relationships broken and new ones initiated, networks of local, regional, and interregional scope persisted in parallel or in nested arrangements that performed different but often complementary functions (more on this in Chapters 4 and 6). Certain coastal settlements will have participated in networks at all these scales, while others, generally smaller or less advantageously sited, did not. Some communities, especially on small islands lacking sheltered harbors and extensive, agriculturally productive hinterlands, were bound to suffer in the reconfigured environment, and Chalandriani-Kastri may be a good example. Yet there were alternative ways to adapt, and many small coastal communities must have been able to ensure their survival by reaffirming traditional links, establishing new ones, or strengthening ties to inland communities.

Building large sailing ships was not necessarily in the best interests or capabilities of small coastal communities controlling minor anchorages. Sails can equally be installed on small boats, even canoes, which could still use all the old landfalls. Thus, the same benefits of an expanded maritime horizon could be realized by small settlements, helping to compensate for periodic reorientations or interruptions in traditional relationships.

One area in which greater knowledge and attention are needed is in the relationship between coastal settlements and their insular or continental interior territories. Small islands, particularly relatively infertile ones such as most of the Cyclades, have little agriculturally productive land, and this has shaped their maritime histories and reliance on external sources of supply. On continental shores and large fertile islands such as Crete or Corfu, relationships with inland dwellers can be important. The complementarity of resources and commodities can stimulate symbiotic relationships, in spite of common difficulties in communication caused by mountainous, broken topography. A town situated on a typical, small coastal plain with limited arable land may seek foodstuffs, timber, and other products from the interior, and these sources may have been more dependable than trade by sea, particularly during the months outside of the sailing season. The Uluburun wreck demonstrates that preserved foods, such as olives and wine, could be transported long distances by ship, but we do not know how pervasive the practice was, especially among small communities. Inhabitants of the interior would have desired certain kinds of imported raw and finished goods otherwise unavailable to them, such as obsidian from Melos, volcanic stone from Aigina or Methana for ground-stone implements, and

metals for fashioning tools and the prestige objects with which they were often buried.

For coastal communities with recourse to relationships by both land and sea, the balance must have fluctuated over time with changing political, economic, and security conditions. The potential of regional-scale archaeological projects to describe and assess the mix of coastal–inland relationships in the Bronze Age is great, but still far from realized. This topic is addressed from a methodological point of view in Chapter 5.

How, then, do these observations apply to the Mycenaeans, who plied the Mediterranean some five millennia after the Mesolithic inhabitants of Franchthi Cave, and the better part of a millennium after the introduction of the sail to Crete? In the LBA, sailing technology was long established in the Aegean; the Mycenaeans may have learned these skills directly from the Minoans, or perhaps through the mediation of the Aiginetans at Kolonna. Their maritime world was expansive within the Aegean, and perhaps they also undertook voyages to Egypt and the Levant – or at least as far as Cyprus and Ugarit – and to the central Mediterranean to visit southern Italy, Sicily, and the Lipari Islands. Yet, these far-flung contacts did not spell an end to local and regional connectivity by land or by sea. In any complex society, no matter how hierarchical, there are multiple nested economies, and the Mycenaeans were no different. Nowhere is this better illustrated than in the territory controlled by the palatial center at Pylos, where Linear B archives and archaeological discoveries reveal a hierarchical society with complex economies, of which the palace controlled only certain key elements. Local and microregional networks of interdependence, which coastal inhabitants shared with inland neighbors or their counterparts on further shores, constituted economies every bit as real, and surely as prevalent, as the "palace economies" or the long-distance exchange of highly visible commodities. One aim of this book, pursued explicitly in the case studies, is to uncover the archaeological signatures of these smaller-scale coastal economies.

Conclusions: Mycenaean Ships and Boats

This chapter has examined the evidence for Mycenaean ships and boats, and summarized what can be surmised of their forms, functions, and performance characteristics. Only the galley is sufficiently widely attested in a range of media to allow a reasonable understanding of all of these categories. A case has been made for several other kinds of ships and boats, for which we have equivocal evidence or no evidence at all. This case has been an interpretive exercise relying on diverse information: contemporary non-Aegean boats, the Flotilla Fresco at Akrotiri, ethnographic data, shipwrecks, and interpretation of iconography and boat models. From this information, it is possible to suggest that the galley was joined in the Mycenaean repertoire by varied types of vessels that we might

label with designations like canoe, fishing boat, rowboat, pilot, coasting vessel, merchant vessel, and so on.

Teasing out a fuller roster of ships and boats, and considering their likely physical and performance attributes, sheds light on the seas, coasts, harbors, and simple anchorages where they would have been active. With their properties and requirements in mind, the next chapter examines the physical characteristics of coastal settings in Greece, and the other parameters – environmental conditions and human skill – of travel to and from them.

FOUR

THE MARITIME ENVIRONMENT OF THE AEGEAN SEA

The navigation of the Aegean Sea, though easy, requires constant attention, and a place of shelter should always be kept in view, so that safety may be assured before dark in the event of an approaching gale; the weather may become so thick that among the labyrinth of islands the land may be hardly seen in time to avoid it. (USNOO 1971a: 18)

Having considered the range of ships and boats that the Mycenaeans used, in this chapter I examine the environmental conditions for seafaring and navigation in the LBA Aegean area. The scope of inquiry must now broaden to include everything from global weather systems to minute local variations, since processes at all these scales interact to generate conditions at sea. I reconstruct many of these environmental parameters of navigation based on both modern data and ancient evidence, and give examples of their consequences for seafaring. I then discuss the practice of navigation in the Aegean, and conclude with speculation about the formation of maritime communities in the Bronze Age, and the means by which they and their knowledge were reproduced and perpetuated through time.

Environmental Conditions for Navigation

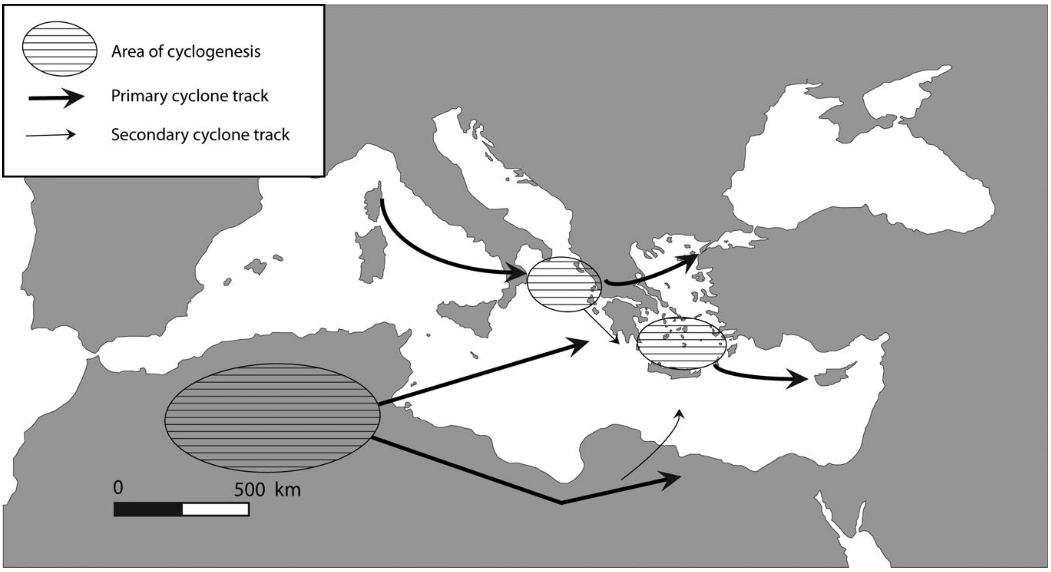
The environmental conditions for navigation in the Aegean Sea are produced by complex interactions of atmospheric, hydrospheric, and lithospheric (terrestrial) forces operating at different scales, i.e., global; basin-scale (Mediterranean); sub-basin-scale (the eastern or western basin of the Mediterranean, or one of its constituent bodies of water such as the Aegean Sea); mesoscale (e.g., contained

within the Aegean); or microscale (local; Robinson et al. 2001: 1). Global atmospheric systems account for much of overall Mediterranean variation, but they are modified by interactions with smaller-scale processes, from basin-scale to microscale, to produce the localized conditions that navigators encounter in the coastal and offshore waters of the Aegean (Oddo et al. 2009). The flows of air and water at all scales are driven by gradients in pressure, temperature, and density, as well as by terrestrial and submarine topography.[1] What follows is a summary of the most salient environmental factors that impact navigation of the eastern Mediterranean, taking account of recent meteorological and oceanographic research and addressing the specific conditions of the Bronze Age.

Global-Scale Processes

At the global level, interactions between the earth's atmosphere and oceans generate massive high- and low-pressure systems that create climate and weather around the world. These systems have distinct seasonal patterns through the year in response to temperature and pressure gradients, solar and lunar gravitational effects, and other factors. In the late Holocene, they have established "typical" patterns or *oscillations* of different scales and durations. For example, the North Atlantic Oscillation (NAO) describes a pattern in winter of low pressure centered over Iceland while high pressure prevails over the Azores. The NAO manifests itself through precipitation, sea-level pressure, sea-surface-temperature storm tracks, and temperature, and is most pronounced between December and March as a result of an increased contrast in sea/air temperature (Mayhew 2004). But these systems are also subject to shifts that may be periodic and predictable, such as the El Niño and La Niña cycles of the Southern (Pacific) Oscillation, or aberrations of unpredictable timing and duration. An extreme shift in the high- and low-pressure centers of the NAO has been implicated in the "Little Ice Age" that brought intense cold to western Europe from the fourteenth to the mid-nineteenth centuries AD, spreading famine and affecting the course of history (Fagan 2000).

Historians and archaeologists have advanced a relatively simple model that places the Mediterranean at the junction of four global atmospheric systems, the interactions of which create the characteristic Mediterranean climate of mild, wet winters and hot, dry summers, and set the conditions for basin- and sub-basin-scale weather patterns (Agouridis 1997: 3; Grove and Rackham 2001: 25–27; Pryor 1988: 15–17). Each system produces successive waves of pressure cells and fronts that enter the Mediterranean through gaps in blocking mountain ranges (Pryor 1988: 15). Generally, systems tracking eastward from the Atlantic interact with the warm Mediterranean water and cold mountain air, as well as with fronts moving south from the Eurasian continent, to produce complex and variable localized weather (Pryor 1988: 16). In winter, the Mediterranean

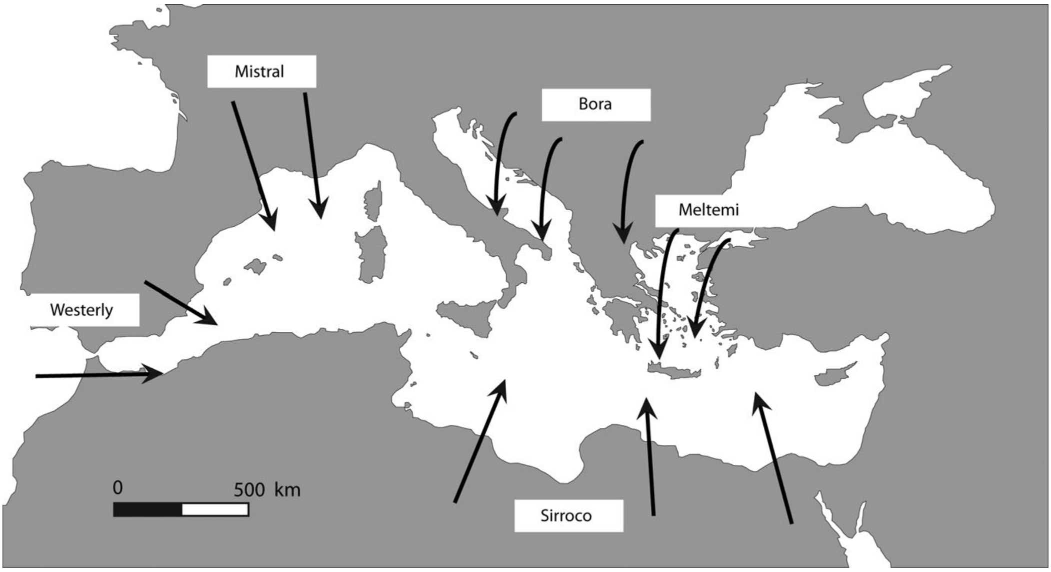


4.1 Centers of cyclogenesis in the Mediterranean. After Brody and Nestor 1980: VI-22, fig. VI-15.

climate is dominated by the effects of the North Atlantic low over Greenland and Iceland (part of the NAO) and the continental Mongolian high. Storms and winds generated by the North Atlantic low track eastward and affect mainly the western basin of the Mediterranean, while the Mongolian high prevails in the eastern basin. In summer, the North Atlantic low retreats toward the pole and the Atlantic subtropical high (Atlantic Oscillation) over the Azores intensifies, exerting strong effects over the western basin. At the same time, the Mongolian high retreats and the Indo-Persian low prevails over the eastern basin. Recent meteorological and climatological research shows the effects of global-scale systems on the Mediterranean to be considerably more complex and far-reaching (see, e.g., Basharin 2004; Bengtsson et al. 1996; Hahmann et al. 2008; Park 2004; Rodwell and Hoskins 1996; Xoplaki 2002; Xoplaki et al. 2006), but even simplistic models demonstrate that shifts and disturbances in large-scale atmospheric systems around the world can have substantial effects on climate and weather at human temporal and spatial scales in the Mediterranean.

Basin-Scale Atmospheric Processes

In addition to establishing a seasonal climate regime, global-scale weather patterns affect atmospheric conditions in the Mediterranean in a variety of ways that impact the maritime environment. Cyclogenesis, the formation of cyclonic storms, is more intense in winter in the Mediterranean than anywhere else in the world (Fig. 4.1). This activity is largely controlled by global air flows and



4.2 Regional winds of the Mediterranean.

climatic trends over Europe, including the influence of the NAO. Cyclones form readily because of the sharp temperature gradient between the cold winter air, particularly from major mountain ranges, and the relatively warm sea surface, which releases heat into the air above. Mediterranean cyclones are smaller than large oceanic cyclones and hurricanes (most are less than 650 kilometers in maximum radius, compared to 1,000 to 2,000 kilometers in the Atlantic), and have shorter lives (averaging 28 hours versus three to three and a half days in the Atlantic). Cyprus and the Aegean Sea are locations where cyclones tend to reach full strength, primarily in winter. Not all of these cyclones are intense and dangerous, but those that are intense are closely linked to high-impact weather, including strong winds accompanied by torrential rains and heavy seas with swells and choppy, short-frequency waves, as is characteristic of the Aegean (Homar et al. 2007). These conditions may generate storm surges that occasionally visit extensive damage on coastal areas.

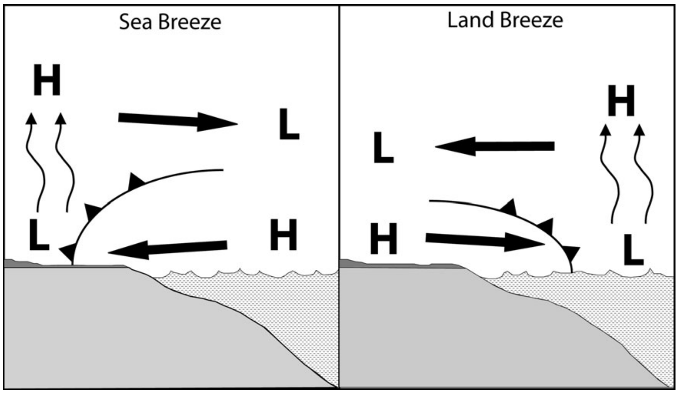
No general wind current dominates the entire Mediterranean basin at any time of year; instead, the variability in topography and global weather patterns prevailing over different parts of the Mediterranean at different seasons gives rise to a number of regional winds (USNOO 1971b: 50–52; Fig. 4.2). Three regional winds, the *meltemi* (pl. *meltemia*; the ancient *Etesians*), the *sirocco*, and the *bora* especially affect the Aegean region. The prevailing winds of the Aegean are northerly throughout the year, but are most marked during the summer months. The meltemia are moderately strong and persistent northerly winds generated by a substantial pressure gradient between a deep summer heat low over the Red Sea and an area of relatively high pressure over the

Eurasian continent. During July and August the meltemia blow steadily over the Aegean, most strongly in the southeastern Aegean, where they interact with landforms to attain a frequency of 80% or more. Such winds can blow especially strongly when funneled into constricted spaces, such as the Doro Channel between Euboea and Andros, or the straits in the Cretan Arc separating Kythera, Crete, Karpathos, and Rhodes (Soukissian et al. 2002: 186–88).

The bora is a cold, dry continental northerly wind that enters the Adriatic Sea through the Trieste gap, where it sometimes encounters a passing depression in winter, spawning violent squalls and gale-force winds.

The sirocco (known regionally under various names), by contrast, is a southerly wind originating in the desert regions across the entire expanse of northern Africa. Siroccos are dry winds that are hot in summer and warm in winter. They transport a great amount of dust, forming haze over the Aegean and contributing to the aeolian content of Mediterranean terra rossa clays (Durn 2003; Yaalon 1997). Affecting mainly the southern Aegean, the sirocco can be accompanied by rain when it intersects with a low-pressure system moving eastward across the Mediterranean, primarily in winter, or when it encounters high relief after absorbing moisture from the sea. When such conditions are absent, the sirocco produces cloudless, hazy conditions by day with low stratus clouds and heavy dew at night (USNOO 1971b: 51).

Regional winds can be complemented, or even augmented, in coastal areas by more localized wind formational processes, including land and sea breezes, mountain and valley winds, and the effects of winds encountering topographic obstacles. Land and sea breezes are persistent, regular features that result from the differential heating and cooling of adjacent land and sea masses (Morton 2001: 51–53; Fig. 4.3). In a typical diurnal cycle, after sunrise the land heats faster because it absorbs heat from sunlight more efficiently but to superficial depths, whereas the sea reflects more sunlight, loses heat through evaporation, and dissipates heat through a greater depth. As temperatures rise through the morning, air pressure builds over land much faster than at sea as warm air ascends, creating a pressure differential that initiates a flow of air well above ground level from land out to sea, and a compensating flow of cooler air from sea to land at ground level. The latter is the sea breeze felt onshore by mid-morning, increasing in strength through the afternoon. As sunset approaches and temperatures begin to drop, the pressure gradient decreases and a period of calm develops in the evening. At night, the opposite process generates a land breeze. As cooling proceeds, a pressure gradient develops as heat is lost more quickly on land. Higher pressure develops over the sea, initiating a flow of warm, rising air toward land, with the compensating flow of cooler air, the land breeze, out to sea at ground level. Another period of calm prevails in the hours around dawn as temperature and pressure differentials are once again minimized. Because heating induces a larger gradient than cooling, and because



4.3 Basic dynamics of land and sea breezes.

sunlight is variable, sea breezes are both stronger and more variable than land breezes. Sea breezes are also more prominent in summer because uninterrupted sunny days and intense heating create particularly strong temperature and pressure gradients. Strong sea breezes can effectively supersede the effects of regional winds in local coastal settings. They can be a help or a hindrance to navigators, pushing boats toward safe anchorage or dangerous shallows.

Mountain (katabatic) and valley (anabatic) winds are generated by the same diurnal cycles that create land and sea breezes (Morton 2001: 53–56). In this case, valley bottoms heat up during the day more rapidly than surrounding peaks and ridges because they are sheltered from winds and their shape promotes radiational heating from enclosing slopes. As air from the valley bottom is heated by the sun (again, more prominently in summer), it flows up the valley walls as an upslope wind, often forming cumulus clouds above the valley rim that may produce rain. Denser, cooler air sinks into the valley to replace the warm, rising air. This mixing creates a more turbulent mass of cooler air that blows along the valley axis in the direction of the prevailing regional winds. At night, the slopes and bottoms cool at a faster rate than they warm during the day, initiating a rush of cold, dense air downslope into the valley and along its axis as a mountain wind (also known as a gravity or drainage wind). Valley and mountain winds are stronger in sunny or clear conditions because of stronger associated temperature and density gradients, and they can be forcefully augmented by regional winds such as the meltemi. Valley and mountain winds affect coastal areas when mountain or stream valleys extend to the coast. A good example is the *vardari* wind that blows down the Axios River valley to the sea in the Thermaic Gulf, which is irregular and can be quite strong.

A type of wind of great concern to navigators is that produced by the displacement of air currents upon encountering topographic obstacles (Morton 2001: 56–61). This displacement can be vertical or horizontal, and the turbulence caused by the disturbance of the air flow ranges from minimal to violent,

depending on a host of factors including wind speed, the stability of the air mass, the angle of the contact, and the shape and height of the topographic feature.

Vertical displacement of wind over an island, promontory, or high coastline produces turbulence as slower moving air at or near sea level is pushed up through faster moving air aloft; the faster the wind speed, the greater the turbulence. If the air mass is stable, that is, not subject to strong differentials in temperature and pressure with altitude, the air passing over the obstacle returns to sea level by flowing down the lee side, but this flow is characterized by strong winds accompanied by atmospheric eddies, wind gusts, and lulls. These conditions produce the well-known phenomenon of violent winds and squalls on the lee side of islands and coastal features. The southern coast of Crete is an excellent example. Psiloriti (2,457 meters) and the other peaks of the central Cretan mountain range place a formidable barrier in the path of northerly winds that blow for most of the year. The extreme vertical displacement of these air masses sends violent winds down the lee side of the mountains to the southern coast, and spawns squalls and gales. This coast is not particularly hospitable in any case, possessing relatively few and widely spaced anchorages, but even anchorages with good water depth and holding ground are generally vulnerable to bad weather from the south in winter and the strong northerly squalls year-round. Modern sailing manuals are full of warnings about sudden, violent squalls that blow down from the mountains, threatening to pull boats from their moorings and anchors, or to dash them against shores and shallows (e.g., USNHO 1951: 111–21). Conditions such as these will have had a significant influence on sea routes, and thus equally on the form that maritime networks of economic and social relations took.

If the air displaced vertically is unstable, usually involving a strong temperature and moisture gradient with altitude, the warm, moist air continues to rise in the atmosphere, causing condensation and forming rain-producing cumulonimbus clouds. These rains tend to fall in concentrated bursts, often as thunderstorms accompanied by cold, powerful downdrafts that spread over the sea, spawning squalls over great distances (Morton 2001: 59–60).

Thus, the effects of topography can intensify winds as well as weather, either episodically, seasonally, or perennially. Yet even if these effects are known and expected, they are irregular and unpredictable because the factors – wind speed and direction, form and orientation of obstacles, season and time of day – are so variable alone and in combination (Morton 2001: 60).

Horizontal displacement occurs when an air stream encounters a low-lying topographic feature, such as a long promontory or a low, broad island, causing a flow of air around one or both sides of the barrier. These flows do not typically produce high winds, except where displaced air is funneled into a narrow gap or strait. The accelerated winds and currents in the narrow strait between Euboea Island and the Greek mainland, or the strait running from the Bosporus to the

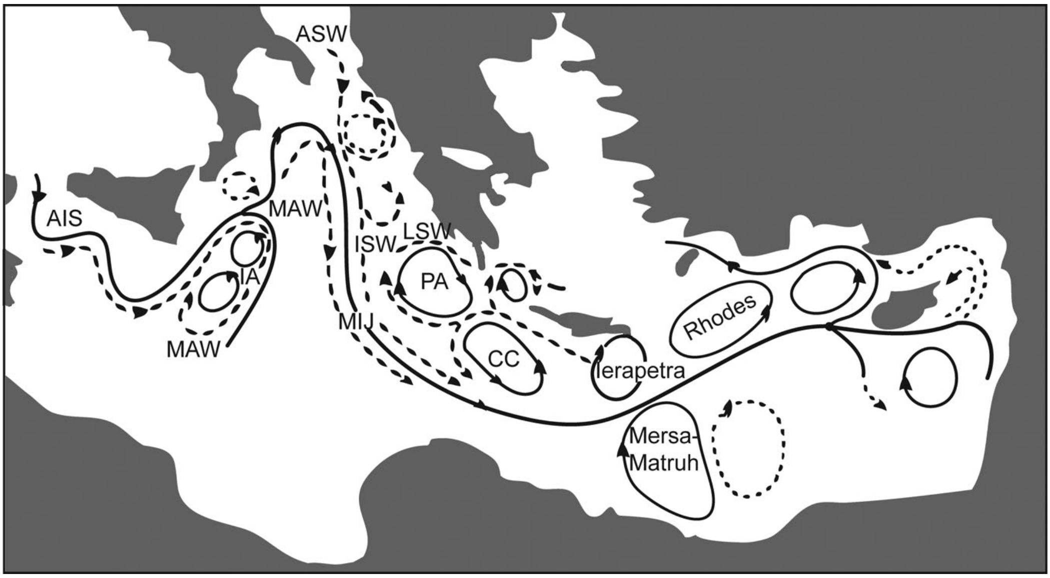
Dardanelles, are characteristic results of the funneling process of flows of air and water.

Basin-Scale Surface Water Circulation and Currents

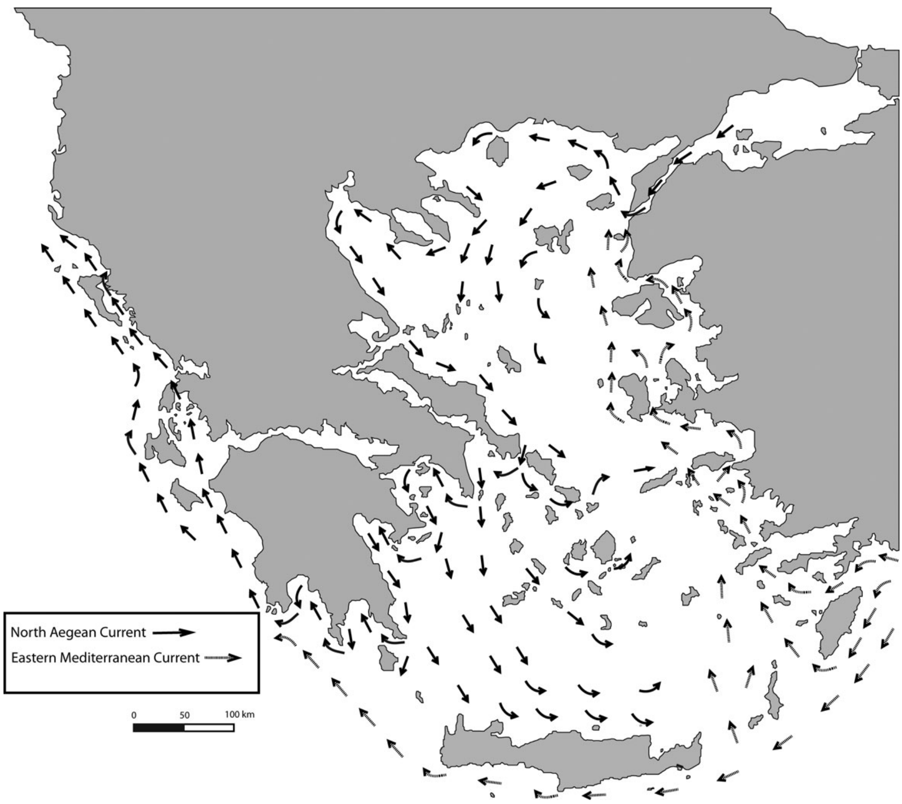
Atmospheric interactions with the sea also play a key role in determining water circulation in the Mediterranean Sea. This circulation is complex because the Mediterranean is large enough to be subject to the same dynamics that characterize global ocean circulation (Robinson et al. 1992: 285, 2001: 1). The Mediterranean Sea is open only to the Atlantic Ocean at the Straits of Gibraltar and to Black Sea waters through the Dardanelles straits. The Mediterranean basin is divided into roughly equal western and eastern sub-basins, with the effective boundary between them lying at the Sicilian straits. Sea circulation is forced by water exchanges with the Atlantic Ocean and Black Sea, winds, buoyancy effects of different water masses at the surface due to water density (temperature and salinity) contrasts (*thermohaline circulation*), and topographic features including islands, coasts, narrows, and bathymetry. There are three types of water masses defined by depth: surface waters, intermediate waters, and deep and bottom waters extending to the sea floor. On an annual basis, evaporation, particularly intense in summer, exceeds the total input of rain and river outflows into the Mediterranean, resulting in water fluxes from the Atlantic Ocean and Black Sea. Most of the deficit is rectified by Atlantic water through Gibraltar (71%), with much smaller contributions from rivers (25%) and the Dardanelles (4%; Agouridis 1997: 3). Thus, water exchanges with the atmosphere drive the influx of lower-density ocean waters, which in turn determines the thermohaline circulation of water and many of the characteristics of the marine ecosystem in each basin (Zervakis et al. 2004: 1846).

Water from the Atlantic enters as a coherent surface stream because of its lower salinity, and thus low density, relative to the Mediterranean water. The flux is most intense in summer when evaporation over the Mediterranean is highest, creating a current of six knots or more. This buoyant stream flows eastward, becoming denser and less coherent as it mixes with other water masses and is affected by evaporation and convection. Along the way, it exhibits instabilities as it interacts with powerful gyres (see below), and bifurcates into multiple pathways, yet it reaches the Levantine coast as a distinct stream (Fig. 4.4).

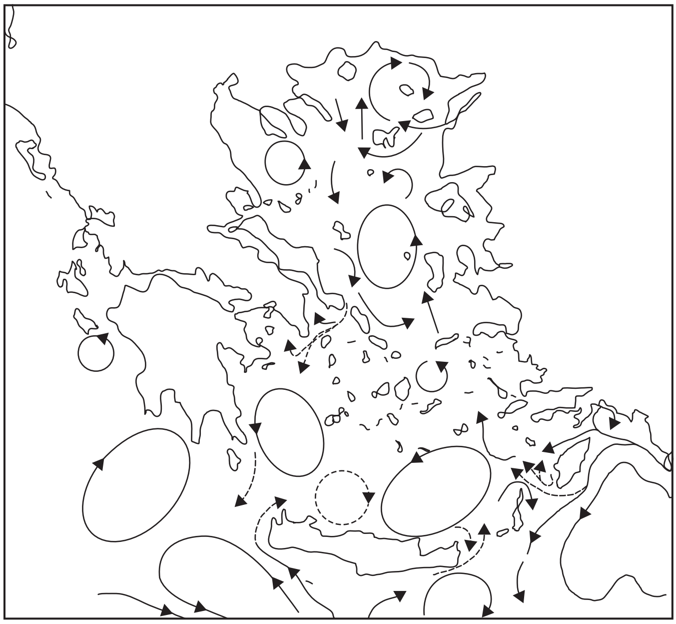
By contrast, the volume of Black Sea Water (BSW) that enters the Mediterranean through the Dardanelles is much smaller and produces significant effects only in the Aegean Sea (Kourafalou 2007; Kourafalou and Tsiaras 2006; Fig. 4.5). The BSW brings less saline and thus less dense surface water into the Aegean to spread over the warmer and more saline intermediate waters. The general cyclonic (counterclockwise) flow of water around the Aegean is promoted by the north- and westward trajectory of the powerful plume of BSW exiting the



4.4 Mediterranean currents and water circulation. Drawing by Felice Ford after Roussenov et al. 1995: 13,516, fig. 1.



4.5 General sea-surface circulation flow in the Aegean. After Papageorgiou 2009: 209, fig. 3.



4.6 Typical positions of major cyclonic and anticyclonic gyres in the Aegean. Data from Olson et al. 2007; Sayin et al. 2011.

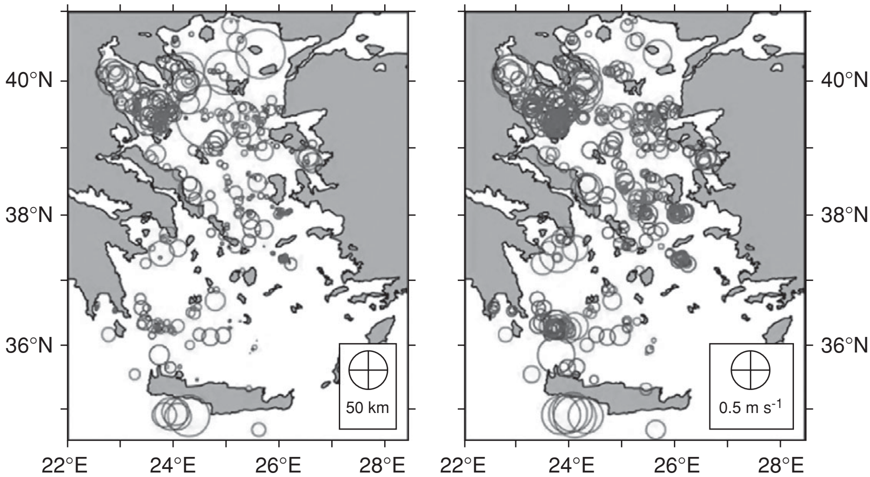
narrow Dardanelles Strait. Driven by buoyancy, winds, and the complicated topography of the Northern Aegean, the BSW is deflected to the west along the rim of the northern Aegean coast, and subsequently driven by strong northerly winds down the eastern coast of Greece. Following seasonal patterns, the current is partially deflected to the Cycladic islands and the central Aegean, and partially pushed southward along the eastern coast of the Peloponnese, where it meets the eastward flow of Mediterranean waters from the Ionian Basin and is entrained by these and by the land masses of the Cretan Arc to flow east into the southern Aegean. Finally, the flow joins the Asia Minor Current (AMC), carrying warm, highly saline Levantine waters north along the eastern coast of the Aegean. When the AMC meets the outflow of the BSW, an intense thermohaline front is formed, which is partly responsible for the strength of the Dardanelles current. In this way the general cyclonic circulation around the Aegean rim is completed.

At sub-basin scale, Aegean currents are constantly affected by *gyres* and *eddies*. Gyres are oceanic surface currents driven by the interaction of the strong Dardanelles outflow with the topography of the Aegean sub-basin, including narrow straits and underwater basins, ridges, and plateaus; the complex shape of the shoreline; and the prevailing northerly winds (Fig. 4.6). Their spiral form is due to the interaction of pressure gradients and the Coriolis effect, which deflects water flow to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. Sub-basin gyres typically have diameters in the range

of 200 to 350 kilometers. They can be cyclonic (rotating counterclockwise) or anticyclonic (rotating clockwise) and their duration can be characterized as permanent, recurrent, or transient. They may also exhibit strong seasonal, interannual, or multiannual behaviors. They are distinct from, but analogous to, atmospheric cyclones and anticyclones. The current temperature and sea surface pressure generated by gyres may exert measurable effects on regional temperature and rainfall as they interact with atmospheric forces.

Similar hydrospheric interactions give rise to mesoscale *eddies* throughout the Aegean, and it is these that most directly affect local – including coastal – currents. Eddies are small-scale currents of water moving against the main current with a circular motion; in the Mediterranean they have diameters in the range of 10 to 14 kilometers, about one-fourth the size of oceanic eddies (Robinson et al. 2001: 5). Like gyres, they can be cyclonic or anticyclonic, and they may be transient or longer lived. They are fairly evenly distributed throughout the Aegean, but anticyclonic eddies occur with greater frequency around the edges of the basin, while cyclonic eddies are more prevalent toward the basin interior.

Eddies are spawned where currents are interrupted by topographic features, or where differences in pressure, temperature, or density exist. Fields of transient eddies form along the border swirl flow of sub-basin-scale gyres; they may then break off to meander in the open sea (Fig. 4.7). In the Aegean, the inflow of BSW at the Dardanelles sets into motion a series of conditions in which eddies emerge, beginning with strong anticyclonic eddies that form in response to the high pressure of the narrow outflow channel and the thermohaline front between the buoyant BSW and the denser Aegean waters. These anticyclones then spread out along the path of the BSW as effects of density gradients. Along the way, the irregular features of the shoreline, for instance headlands or peninsulas and deep inlets, modify the path and motion of currents, spawning eddies that can ride along linear coastlines and fill bays. Donald Olson and colleagues (2007) describe the effects of eddies in the large Thermaic Gulf (with Thessaloniki located at its head). Some of the BSW flow enters the gulf, creating a dense pattern of eddies, dominated by cyclones at the mouth of the bay and anticyclones within it. The anticyclonic rotation forms a rim current that is intensified by the inflow of three major rivers (the Axios, the Aliakmon, and the Loudias) into the gulf. The current is further complicated by the effects of two northerly winds, the meltemi and the local *vardari*, a strong northwesterly valley wind that blows irregularly from the Axios (ancient Vardar) river valley (Olson et al. 2007: 1904),[2] as well as a sea breeze that forces strong diurnal surface currents within the gulf (Hyder et al. 2002). Contexts such as the Thermaic Gulf amply demonstrate multiscalar atmospheric, hydrospheric, and terrestrial forces interacting to create local conditions that are highly malleable and distinctly seasonal (Kourafalou and Barbopoulos 2003).



4.7 Distribution, size, and intensity plots of eddies in the Aegean. Olson et al. 2007: 1914, fig. 15. Courtesy American Meteorological Society.

Waves

Wind stress, the drag or tangential force exerted on the earth's surface by adjacent layers of moving air, is the principal engine of oceanic wave formation (Morton 2001: 30–37). These waves travel in the direction of the wind, gaining height and strength so long as the wind continues in the same direction and the waves do not encounter topographic obstructions. Once the wind stops or changes direction, the wave continues some distance under its own momentum, sometimes causing the clashing of waves moving in different directions. The gales, squalls, and other stormy weather typical of the Aegean can produce rough seas with high waves and swells. Because of the irregular pattern of wind flows and gusts, waves in the open Aegean tend to be choppy, short-frequency waves that would have been dangerous for the small craft of the Bronze Age (Broodbank 2000: 101). The concentration of stormy weather and rough seas in winter explains the general avoidance in antiquity of open-sea sailing in the Aegean from October to March. Once waves approach coastal areas, they are affected by several factors that determine their contact with the coast and the effects they might visit upon watercraft and coastal settlements. Among these factors are the form and magnitude of the wave, measured by wave height and wavelength; wind speed and direction; the angle of contact with the coastline; and surface and subsurface topography along the coast. The configuration of the coastline, including its shape and the extent and form of any submarine coastal shelf, may serve to magnify or minimize the force of waves breaking against the land mass. In general, shorelines with long promontories and gradually sloping underwater shelves extending far out to sea induce waves to break well offshore, minimizing potential wave damage. By contrast, shorelines that slope steeply

into the sea with little offshore hindrance to water movement can magnify the violence of waves breaking on the shore. Considerations of protection from damaging waves are similar to those of exposure to winds, and figured in the placement of harbors in the Bronze Age.

The combination of intense weather events, northerly winds, waves, topography, and swift current flow with complex patterns of eddies affecting the western coast of the Aegean is implicated in many shipwrecks in recorded history. Perhaps the most famous of these befell the Persian fleet in three separate incidents during invasions of Greece in the early fifth century BC. In 492, Darius's fleet under Mardonius was wrecked by a northerly gale while rounding the Athos peninsula (Herodotus 6.44). Many of these ships were battered against the rocky peninsula. Later, Xerxes' fleet suffered two major shipwrecks in the summer of 480 BC. The first of these occurred on the long and nearly harborless Magnesia coast near Artemision/Cape Sepias (Herodotus 7.188–92). There, a great four-day storm driven by meltemi winds from the northeast roiled the sea in high waves, sinking ships caught in the open sea and dashing others onto the rocks along the rugged coastline. Remarkably, Herodotus records that locals called these storms "Hellespontian" (i.e., originating in the Dardanelles). The third disaster took place while the fleet was sailing off the "Hollows of Euboea," that is, the eastern coast of the southern half of Euboea, before entering the Doro Channel (Herodotus 8.12–13). In that event, a violent storm driven by northerly winds rose at night and dashed ships against the coastal rocks. These calamities present a characteristically Aegean cocktail of hazards: violent squalls and heavy seas that arise at night, forced by high northerly winds and swift, shifting coastal currents, driving ships toward nearly invisible rocks and shoals on a rugged coastline with few opportunities for safe anchorage. The Persian shipwrecks also illustrate the way that phenomena at all scales, from global to local, interact to produce conditions experienced at human scale.

Aegean Variability

By virtue of its geographical position – a long north to south axis closed in on the north by the land masses of Greece, Anatolia, and the Balkans, and in the south opening into the broad eastern Mediterranean – as well as a complex topography, the Aegean Sea creates a unique maritime environment. The environmental forces that drive atmospheric and hydrospheric circulation converge and cross-cut the Aegean basin in such a way that local conditions, resulting from the interaction of forces operating at all scales, are highly diverse and changeable. The greatest differences are evident as one moves from north to south, through successive influences of continental, Mediterranean, and desert climatic zones, but significant contrasts also occur between the mainland

and islands, as well as between contrasting topographic settings regardless of geographical location. Furthermore, seasonal patterns in environmental conditions give a very different character to a given coastal setting through the year. A brief survey of atmospheric conditions in the Aegean, and an example of seasonal variation at a single Aegean port, will highlight some of these contrasts.

Atmospheric Conditions in the Aegean Sub-Basin

The Aegean Sea is not excessively windy, cloudy, or stormy when compared with ocean waters such as the North Atlantic. Gales and storms of Beaufort 8 and higher (winds in excess of 62 kilometers per hour) occur in 5% or fewer observations, while light to moderate squalls are somewhat more frequent at 10% in winter, but only 2% in summer (USNHO 1952: 10). Dead calms are also rare, however.

Summer disturbances differ from those in winter. In summer, low-pressure disturbances tend to pass over the Eurasian continent, well north of the Aegean, or remain to the west of Greece. In frequency and severity these are greatly reduced from winter, rarely interrupting the prevailing northerly winds or local sea and land breezes.

Winter gales may arise from several directions, associated with depressions moving east-northeast past southern Greece from Libya, or east-southeast from Italy to cross the Greek mainland. Winter winds are more variable and unstable because of the greater number of high- and low-pressure systems that move through the Mediterranean, which determine the occurrence and severity of winds and storms. Low-pressure systems (depressions) crossing the Mediterranean from the west are often preceded by strong southerly winds. Once a storm passes over the Aegean, the wind shifts through several directions and brings showers and squalls. At other times, cold polar air from high-pressure systems over the Eurasian continent may pass to the south, pushing against the depression and generating strong winds from the north or northeast, accompanied by showers, sleet, or even snow. These storms are particularly dangerous at night on the windward side of coasts and islands because of low visibility and heavy seas; ships encountering these conditions are well advised to make for southern, lee shores. If the continental high enters the Aegean with no depression to the south, skies will be clear with strong northerly winds. The general winter pattern is that the northern Aegean remains chiefly under the influence of the continental high, and thus northerly winds, while the southern Aegean experiences frequent low-pressure systems and a mix of southerly and northerly winds. The frequency of strong winds varies by island or coastal location, and by windward or leeward position. Temporally, the greater frequency of storms and dangerous sailing conditions in winter defined the nonsailing season, as

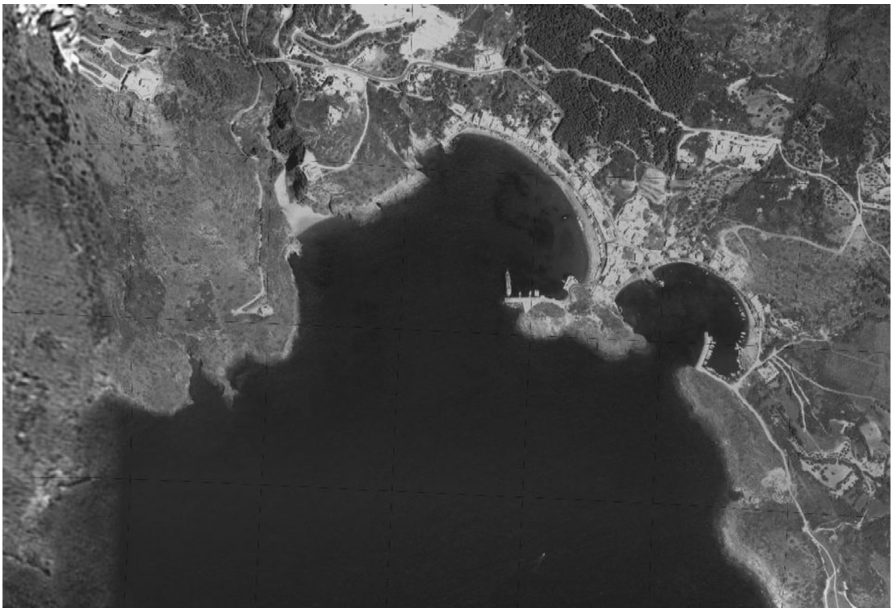
we know from ancient Greek sources beginning with Hesiod (*Works and Days* 620–95), but these conditions did not preclude maritime communication completely, as we shall see.

The prevailing winds from the north are most marked during the summer meltemia. Although meltemia are fair-weather winds, when blowing strongly they may kick up "white squalls," so named after the appearance of agitated water in sunlight. Locally, however, these and other winds can vary widely due largely to topography, and in summer to land and sea breezes. While land breezes are always light, sea breezes may be strong enough to disrupt or even eliminate the effects of the meltemi. An example of this phenomenon is the coastal promontory at Gytheion in Laconia. There, the meltemi is dissipated by the Taygetos mountains to the north, which shield the Gytheion area. Instead, sea and land breezes dominate during the day, with gusts off the mountains occurring at night. When forceful, sea and land breezes can be used strategically by navigators to make progress against prevailing winds and currents. By contrast, at Kythera Island off the south coast of the Peloponnese facing Gytheion, the meltemi becomes the prevailing wind in late summer as the sea warms and consequently the sea breeze generated by land/sea temperature differentials diminishes (USNHO 1952: 11). The north-facing anchorages are particularly vulnerable to northerly and westerly winds (Heikell 2007: 144–48).

Cloud cover is light overall, with summer skies seldom overcast, but heavier in winter when most precipitation falls. When clouds do occur, a diurnal pattern of minimal cloudiness in the morning, followed by increasing clouds in the afternoon and dissipation in the evening, is common throughout the Aegean. During winter, cloud cover averages 50%, with little variation from November to April. Great banks of clouds shrouding mountain summits often precede bad weather, especially in the northern Aegean.

Consistent with a characteristic Mediterranean climate, the Aegean region experiences distinct wet and dry seasons, with most rain falling between October and March (Xoplaki 2002: 10–12, figs. 1.1, 1.2). Driven by the great weather engines described above, the precipitation of early winter is often heaviest as warm, moist air forming over the open Mediterranean comes into contact with cold, drier polar air lying over the Eurasian continent.

Rainfall patterns across the Aegean basin are variable; the frequency, timing, and amount of rain a particular locality receives depend on several factors. In the northern Aegean, southerly winds contribute most of the rain, though northerly systems sometimes deposit snow. In the southern and central Aegean, southerly, westerly, and northerly winds can all bring rainfall. Because Mediterranean depressions carry abundant moisture, the islands of the southern Aegean, exposed to eastward-tracking depressions from the central Mediterranean, receive more rain than the Greek mainland, but in lower-frequency, higher-volume events. Rains seldom last for more than a few days at a time. On



4.8 Satellite image of Kapsali Bay, Kythera. Image © 2011 Google Earth, © 2011 European Space Imaging.

the mainland, rain occurs most frequently in the afternoon, while over the sea and islands, rainfall at night or early morning is more common.

Sometimes rain effects are topographic in origin. The northwestern Greek province of Epirus is an area of high rainfall because storm systems crossing the mainland from the west are halted by the Pindos mountain range. There, the clouds release rain ("orographic rainfall": Morton 2001: 64–65), which then drains down the western side of the Pindos to feed large perennial streams and springs. A corresponding "rain shadow" region on the eastern side of the Pindos is much drier. In the mountainous Greek terrain, such rain surplus and deficit relationships are common on both macro- and microregional scales, detectable, for example, even between Athens and its northern suburbs. All areas of the Aegean are also subject to potentially large interannual fluctuations in rainfall, which in drier areas such as the Cycladic Islands can have dire implications for subsistence (Broodbank 2000: 76–78).

Seasonality at Kapsali Bay, Kythera

The harbor at Kapsali Bay, on Kythera's southern coast, provides a typical example of the seasonally changing environmental conditions experienced at a southern Aegean anchorage (Naval Research Laboratory 2007). The southwest-facing harbor exhibits a classic configuration favored in the Bronze Age: a double-lobed harbor formed by a protruding headland with small, indented bays on either side (Fig. 4.8; see Chapter 5 for the configuration of Bronze Age

harbors). The headland separates a larger, less sheltered western harbor from a smaller, shallower eastern harbor that is better sheltered by a narrow entrance. Kapsali Bay has relatively few modern built installations that artificially alter the impact of seasonal weather conditions. Boats may find mooring within the bays or lie at anchor just outside them.

Facing southwest, Kapsali Bay is exposed mainly to winds and weather from the west and south. The steep relief of the land to the north shields the harbor from the prevailing northerly winds, but when these are particularly strong, powerful gusts and squally weather can be produced by the vertical displacement of winds to the lee side of this prominent topographic feature. At the same time, coastal sea breezes flowing north are strongest in summer and may offset the prevailing northerlies, resulting in light wind conditions in the afternoon and early evening.

In spring, a long transition occurs between winter and summer conditions. Migratory winter cyclones may continue to arrive from the west well into May. Southerly siroccos peak in frequency and intensity in spring, and if particularly strong may make the harbor unusable for small craft (Heikell 2007: 146). They bring cloudy conditions with light rain and dust (producing "red rain"), with winds of 22 to 33 knots and waves of 1.1 to 2.1 meters. Sirocco events may last for several days, but because they develop slowly over a day or two and are preceded by altocumulus clouds, they can be anticipated and proper precautions taken. When stormy conditions are not present, northerly winds prevail.

Summer brings typical Mediterranean conditions: a nearly cloud-free, precipitation-free sky with warm temperatures and few hazardous weather concerns. Northerly winds prevail, notably the meltemi, which may be felt at varying strength from May to October. Strong meltemi winds may persist for days at a time, but the effects are usually diminished by a counteracting sea breeze. The onset and first day of a meltemi event may be marked by thunderstorms in May to June and September to October, but in July and August only by scattered altocumulus clouds.

In autumn, the onset of the winter pattern is usually rapid, occurring around the third week of October. The first storms of the season are migratory cyclones from the west. Though these are not as intense as later winter weather, they often catch sailors unprepared and cause damage for this reason.

The most difficult navigational conditions occur in winter. The prevailing northerly bora winds may reach 41 to 47 knots and cause early morning temperatures to drop to near freezing, with little warming during the day. The most hazardous conditions are initiated by migratory cyclones approaching from the west, accompanied by low clouds, heavy rain, high winds, and reduced visibility. As they pass over, winds may shift abruptly from northerly, to easterly, southeasterly, and finally southwesterly with ever increasing wind speeds.

These storms produce waves of 3.3 to 4.3 meters, in which case watercraft anchored outside the sheltered bays are fully exposed to squalls and battering waves.

Kapsali Bay, like any other Aegean landfall, presents distinctive local characteristics due to its geographical location, exposure, and configuration, while at the same time experiencing a typical range of seasonal conditions generated by the interplay of the broader environmental forces examined in this chapter.

Implications of the Environment for Aegean Navigation

The foregoing examination of the maritime environment of the Aegean region highlights several implications for Bronze Age seafaring. One of these is that although there are certain broadly predictable patterns of climate, weather, and conditions at sea, these can turn unpredictable and changeable at the scale of human experience. The sudden squalls, storms, and heavy seas reported from antiquity to the modern day often arise with little warning even when the general patterns of hazardous weather are well known. The captains of the Persian fleets, with their imperfect knowledge of local conditions along the western Aegean coast, learned this to their cost. Apart from weather hazards lasting for a few hours to a few days, longer-term anomalies arise because the circulation of air and water in the Aegean is governed by systems operating at multiple, interacting scales. The more extreme case of Europe's "Little Ice Age" shows that centuries-long environmental shifts are possible.

We can assume that similar kinds of anomalies, at least those of short duration, occurred during the Mycenaean period, though we have no empirical evidence for them. A great deal of speculation has surrounded climatic disturbance, usually a decadal-scale pattern of drought, as a possible contributor to the collapse of the Mycenaean palatial system (Carpenter 1966), but our data – whether from pollen, tree rings, ice cores, terrestrial and deep-sea sediments, or other proxy measures – lack sufficient geographical and chronological resolution to demonstrate this or indeed any specific environmental anomaly during the Mycenaean period. The most we can say is that by the mid-Holocene (roughly 5000 BC), the basic climatic conditions that we experience in the Mediterranean area today were in place (Loy and Wright 1972: 40; McCoy 1980), and global (eustatic) sea level had stabilized at just a few meters below current levels (Lambeck 1995, 1996). It is likely, therefore, that the environmental anomalies of recent centuries, for which we have historical accounts and some meteorological data, approximate those encountered in the LBA. This means that Mycenaean sea captains faced weather-related hazards similar to those encountered by their later counterparts prior to motorized watercraft and advanced navigational aids.

The winds and currents described in this chapter also made it possible for boats – whether paddled, rowed, or sailed – to make progress on the sea. These movements normally followed the prevailing winds and sea currents, but knowledge of local winds, coastal currents, and land and sea breezes often made it possible to move against the dominant forces in short segments. This ability to move about locally also broadened the horizon of maritime activity by extending the sailing season, and significantly promoted the kind of short-distance connectivity that led to the formation of the maritime "small worlds" to be described in Chapter 7.

Equally important to Mycenaean navigation were the topographies of coastal landscapes. These were normally stable over the scale of a human lifetime, though as we will see in Chapter 5, modern coastal configurations are often dramatically different from those of the Bronze Age. Working in favor of Mycenaean navigators were the thousands of islands and highly irregular coastlines of the Aegean, indented with an abundance of natural harbors and anchorages. It was possible to traverse most of the Aegean, and in fact much of the eastern Mediterranean, with land always in sight, the main exception being the Libyan Sea between Crete and northern Africa (Fig. 4.9). When bad weather conditions arose, some form of safe anchorage was usually within reach, but it must be emphasized that the hazards of shallow coastal waters, if not known to the crew or in adverse weather, could be just as dangerous as running out to the open sea. Because suitable landfall was rarely more than a day's travel from any harbor within the Aegean, there was little need for night voyaging unless one left the Aegean Sea proper (by choice or when blown off course).

For these reasons, coast- and island-hopping facilitated movement by sea in the Aegean, and travel by sea was bound to play a fundamental role in the development of early Greece. The evolution of navigational skills is apparent in the archaeological record (Papageorgiou 2009: 199–200). Beginning with indirect evidence of sea travel in the presence of Melian obsidian at Franchthi Cave in the late ninth or early eighth millennium BC,[3] subsequent millennia saw traces of inhabitation on several islands and the colonization of Crete in the seventh millennium. Over the following 3,000 years, Aegean islands and mainland coastlines were gradually settled, until during the EBA (third millennium), proto-urban settlements and dense maritime communications were established (Broodbank 2000; Cherry 2004). These networks, along with technologies including the sail, were well developed by the time the Mycenaeans emerged as a complex society with ambitions beyond the Greek mainland.

The omnipresence of coasts and islands was also a hindrance to safe navigation, however, and this was a fundamental condition for the formation of navigational techniques in the Aegean. The quote that opens this chapter, taken from a twentieth-century sailing manual, succinctly makes the point that navigating the Aegean was more a problem of pilotage through complex coastal

4.9 Visibility of land from the sea in the Mediterranean. After Broodbank 2000: 40, fig. 4.

and near-coastal topographies under the influence of varied environmental conditions than a matter of celestial navigation, dead reckoning, or other means of way-finding on the open sea. Thus, despite the obvious advantage of constant visibility of land, knowledge of local coastal conditions was paramount to ensure safe passage and landfall. Ancient texts are replete with stories of ships run afoul of coastal hazards while trying to make safe landing. To cite an example, one of the misadventures of St. Paul's long sea journey from Palestine to Rome was shipwreck on the coast of Malta (*Acts of the Apostles* 27.6–28.10). After being blown off course from Crete for several days by a raging storm, the ship's captain spied a bay with a sandy beach on the Maltese coast, but on approaching, the ship ran aground on a sandbar, became wedged, and was destroyed by the pounding waves. Such disasters as befell the Persians in 492 and 480 BC or St. Paul in the early years of the Roman Empire were undoubtedly common, and underscore not only a general need for knowledge of local conditions – or better perhaps to highlight the consequences of not having that knowledge – but also support the argument for the prevalence of short-distance connections among those with local experience, leading to the formation of maritime "small worlds." A detailed examination of coastal landforms and navigational conditions in the Aegean in Chapter 5, along with case studies in Chapter 7, will permit these arguments to be developed in full.

These peculiarities distinguish the Aegean from other seas with which it is often compared. For example, ethnographic accounts of navigation among aboriginal South Pacific islanders are often found appealing as comparative material because they offer detailed studies of navigational techniques that do not rely on modern instruments or advanced seacraft, not to mention insights into maritime communities and their social and economic links with similar communities both

near and far. Among these insights is a better understanding of how a pre-literate society can develop and disseminate sophisticated systems of navigation based on detailed observations of celestial bodies and other environmental features.

Yet although many of these insights are useful and even compelling, fundamental differences must be kept in mind. Broodbank (2000: 38–43) examines the similarities and differences of low-technology voyaging in the Mediterranean, Caribbean, and southwestern Oceania. In spite of comparable challenges inherent to small wind- or human-powered craft, and even some similarities in social and economic organization, Broodbank points to fundamental differences between the Cycladic Islands of the Early Bronze Age and these other areas. One of these is the basic geography of the island chains. In the South Pacific, islands are much more isolated, separated from one another and from any continent by great distances with a seemingly boundless sea intervening. These geographical factors have had a profound effect on the way that social and economic relationships developed over time among the scattered island communities. To a much greater extent, the proximity of Aegean islands to each other and to continental land masses created a profusion of potential maritime routes and situated coastal communities within range of recurrent external influences.

To Broodbank's observations we might add that a very different kind of navigational skill was required for a navigator departing in a small sailing canoe from one tiny Pacific island for another, often hundreds of nautical miles away. The main objective was to avoid missing a tiny speck of land in a vast sea, since the consequence of deviating even a few degrees off course might be to be lost in the open sea. Indeed, from time to time, canoes departed, never to be seen again. Other voyages turned into long adventures of missing the target (due to navigational error or inclement weather), only to turn up at some other island, where the errant crew might remain for a time before returning (Feinberg 1988: 25–31). Most such voyages were successful, however, and to make this possible an elaborate and complex system of navigation using celestial observation of the movements of the sun and stars was developed, partly independently and partly through shared traditions, by many island societies in the South Pacific (Feinberg 1988: 87–118; Gladwin 1970: 145–213; Thomas 1987: 73–85). By contrast, so long as the Mycenaeans were traveling within the Aegean, Ionian, or Adriatic Seas, or along the coasts of the Levant or southern Asia Minor, they could choose to avoid the open sea, instead navigating by coastal and island landforms and relying on their knowledge of safe anchorages en route.

This is not to say that Mycenaeans did not undertake open-sea voyages, or that they were ignorant of celestial navigation. Within the Aegean, ship captains often had a choice between a circuitous coastal route and a more direct open-sea voyage. The decision involved considerations of the ship's structural fitness and equipment (sailing rig, oars, crew, provisions, etc.), the captain's and

helmsman's experience, the expected environmental conditions (winds, currents, weather), and the urgency of a speedy arrival (McGrail 1991: 88–89). These dilemmas figured prominently in the return of the Homeric heroes from Troy (McGrail 1991: 88). After arriving on Lesbos, Nestor, Diomedes, and Menelaus debated two island-hopping routes for their return to the Peloponnese, one sailing through the narrow channel between Chios and the Anatolian coast before turning west to the northern Cyclades and thence to Euboea and Attica; and the other keeping west of Chios between that island and Psyra before also turning west to the Cyclades and beyond. Nestor, after inquiring of Zeus, chose instead a direct open-sea voyage to the southern coast of Euboea, keeping Psyra to port (*Odyssey* 3.169–79). Interestingly, none of these routes is favored by winds or currents, yet Nestor reports that his ships, taking the open-sea route, were able to run before a freshening wind astern, reaching Karystos in southern Euboea by dawn the next day. The route ostensibly favored by environmental conditions was long, possibly involving a crossing toward Skyros in the northern Sporades before turning south to catch the prevailing winds and currents along the eastern coast of Euboea. Matching environmental expectations more closely is a journey found in Odysseus' phony tale of his youthful exploits on Crete (*Odyssey* 14.252–57), in which he describes a plausible sea voyage from Crete to Egypt, riding a northerly wind down the lee side of Crete and arriving at the Nile in just over four days. The journey from the Aegean to Egypt illustrates the fact that when ancient ships left the familiar confines of the Aegean, they encountered extended periods of days (or even weeks if things went wrong) in the open sea, often out of sight of land. Because these trips involved sailing at night, some means of staying the course was necessary. Homer's sea captains were familiar with stellar navigation: after leaving Calypso's island, Odysseus set a course for seventeen days with reference to the Pleiades, the "late-setting Ploughman" (*Arctophylax*), *Ursa Major* (our Big Dipper), and Orion (*Odyssey* 5.270–77). There is an important difference between the use of prominent stars and constellations to determine orientation and rough geographic position, and the Pacific Islanders' technique of "star path steering," which relies on an intimate knowledge of the rising and setting azimuths of numerous stars, as well as the ability to correct for winds and currents en route (Davis 2002: 298–99). There is no evidence in the Homeric text that Odysseus used this technique in his voyage from Calypso's island (Davis 2002: 299–300).

The fact that night sailing by means of celestial navigation was reasonably well established by the time Homer's epics were set to writing, circa 700 BC, is no proof that Mycenaean sailors were similarly capable more than a half-millennium earlier (McGrail 1991: 89). Indeed, many modern scholars are skeptical of LBA celestial navigation (e.g., Chryssoulaki 2005: 79; Lambrou-Phillipson 1991: 13). Yet there are reasons to believe that such knowledge already existed in the

Bronze Age. Christos Agouridis (1997: 17) develops an argument in favor of celestial navigation in the Aegean Early Bronze Age that, although lacking direct archaeological evidence, is in many respects compelling. The material evidence that *is* preserved reflects intensive engagement with the sea by EB II, including a proliferation of fortified coastal settlements and the movement of goods by sea throughout the Aegean. Given that the most sophisticated seagoing vessel of the period was the paddled longboat with a maximum daily range of 40 to 50 kilometers (Broodbank 2000: 102), some journeys must have involved overnights on the sea. Meanwhile, a novel suite of iconographic symbols related to sea, sky, and maritime travel emerged in the Cyclades in EB II (Broodbank 2000: 249–53, fig. 81). The ceramic "frying pans" of Syros type carry incised depictions of longboats, fish, sun/star symbols, and abstract "sea spirals" that probably represent billowing waves. The co-occurrence of incised fish, sea spirals, and a sun/star on an early frying pan from the Louros Athalassou cemetery on Naxos (Fig. 4.10) is suggestive of celestial navigation. Adding to the material evidence, Agouridis invokes ethnographic parallels of widespread celestial navigation and open-sea voyaging among Pacific and Caribbean islanders to argue that people engaged intimately with the sea and making long sea crossings will naturally observe the position and movements of heavenly bodies and realize their potential for tracking one's location and destination, likely out of necessity while on the sea at night.

The contrast between seafaring as presented in the Homeric epics and as known from archaeological evidence of the LBA eastern Mediterranean may shed further light on the question of celestial navigation. Jan-Paul Crielaard (2000) observes that long-distance maritime relations in the LBA were far greater in scale, more complex in organization and infrastructure, and served a wider range of exchange relationships than those depicted in the *Iliad* and *Odyssey*. The dense networks of trade in raw materials and finished goods, the elaborate harbor facilities of Egypt and the Levant, and the long-distance political relationships among the great states of the eastern Mediterranean had largely evaporated in the Early Iron Age, and do not figure in the epics. Crielaard's principal aim is to show that seafaring provides additional support for the argument, widely accepted today, that the world of the Homeric epics should be situated close to Homer's own time, if to any historical period at all (Bennet 1997; Morris 1997). But another implication of his arguments can be expressed as a question: If long-distance seafaring was better organized and more sophisticated in the LBA, would it be surprising to learn that Mycenaeans sailed at night and navigated by the stars, as did Homer's sea captains? The Homeric texts, together with iconographic evidence for a gradual development of the oared galley from late Mycenaean times to the Geometric period (see Chapter 3), do not imply significant technological progress. Although this is not conclusive

4.10 Sun, sea spirals, and fish incised on an Early Cycladic frying pan, Louros Athalassou cemetery, Naxos. © Hellenic Ministry of Education and Religions, Culture and Athletics/ Archaeological Receipts Fund. Courtesy of the National Archaeological Museum, Athens.

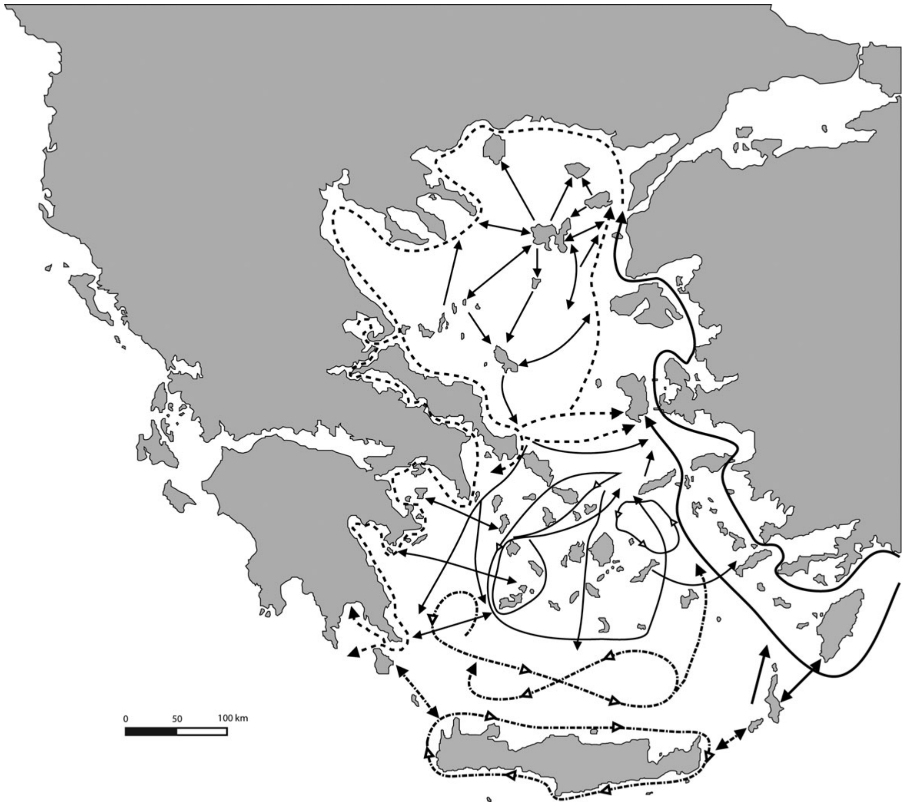
proof, I am inclined to agree with Agouridis (1997: 17) that the use of celestial navigation for nighttime voyages on the open sea is virtually certain for the Aegean Bronze Age. Moreover, it may be that there was a division in Mycenaean maritime societies between master navigators, able to steer ships on long open-sea journeys by celestial navigation, and those whose knowledge was limited to local and daytime trips. This would parallel the recent situation in the South Pacific, where most ocean travel occurred within a short distance of a given island and the majority of men became adept at it, but only a handful achieved the level of navigational skill required for long open-sea journeys (Feinberg 1988: 88–91).

Even when Mycenaean captains chose to avoid open-sea voyaging when possible, it does not mean that their vessels hugged the coast too closely (Mark 2005: 139–42; Morton 2001: 143–72). Apart from the navigational hazards, known or unknown that lurked in coastal waters (pilotage along a coastline at night was particularly dangerous), the purpose of a voyage affected the desirability of a coastwise route. There might be little reason to stray far from shore for fishing excursions, or for visits to nearby coastal communities for social or trading purposes. Longer trading voyages involving multiple stops en route to buy and sell goods might also necessitate a coastwise, harbor-to-harbor strategy in which the vessel traveled a safe distance from the coast, but could quickly make for a harbor or anchorage to trade or to find shelter. In this case, the route reflected not fear of open-sea voyaging, but economic sense. As mentioned above, ships traveling near-coastal routes might also take advantage of coastal breezes and currents to make headway with or against prevailing winds. On the other hand, when the intention was to travel quickly from one place to another with little interest in intervening locations, a direct route over open sea was often preferable if environmental and human conditions permitted.

Sailing Routes in the Aegean

Although the proximity of myriad islands and coastlines presented almost unlimited hypothetical routes crisscrossing the Aegean, certain dominant and habitual routes may have emerged over time. There can be little doubt that environmental factors strongly influenced the routes that sea travelers followed around the Aegean in the Bronze Age. Winds, currents, topography, and seasonal weather patterns combined with technologies of shipbuilding, propulsion, and navigation to give shape to a range of possible routes and seasonal schedules. If these factors were sufficiently determinative, certain well-traveled sea lanes could be formalized over long periods of time, with a consequently strong impact on the pattern of social relations. Here a crucial question arises: Did environmental forces play a determining role in coastal settlement patterns, and even in maritime social relations? That is, did coastal communities arise or flourish because they were positioned advantageously with respect to sea paths favored by environmental forces such as winds and currents? Further, were their external relations patterned, or even determined, by movement along these favorable routes? If so, it should be possible to create a simple predictive model for the existence of significant Bronze Age coastal settlements at well-placed nodes along these routes.

Models that emphasize the role of environment on the formation of maritime networks in the Aegean Bronze Age have often been proposed, perhaps most cogently in recent years by Agouridis (1997) and Despoina Papageorgiou (2008, 2009). This approach has generally involved creating maps of hypothetical sea lanes based on environmental factors, particularly currents and/or winds, and then plotting the known archaeological sites for a given period to assess the fit between these two sets of data. Agouridis (1997: 6–15) shows how the currents and winds may have facilitated the dense connections implied by the archaeological evidence. He stresses that proximity can be misleading: islands close to one another but separated by rough seas may have had little contact (Agouridis 1997: 19). Papageorgiou strongly emphasizes the role of sea-surface circulation, determined by wind- and density-driven sea currents: "It is clear that the sea circulation contributed decisively to forming the routes of prehistoric ships in every direction, and to establishing sea lanes between all the mainland coasts and the Aegean islands" (Papageorgiou 2009: 204). On the basis of sea circulation patterns, she proposes six principal Aegean sea routes, with numerous potential subroutes (Fig. 4.11). These include both open-sea and coastal routes, since Papageorgiou believes that open-sea and off-season travel were practiced whenever and wherever environmental conditions were permissive. Having established these routes, Papageorgiou examines the archaeological evidence for site location and activity in the Neolithic and Early Bronze Age. She concludes that prehistoric coastal settlements ". . . were invariably founded on small promontories



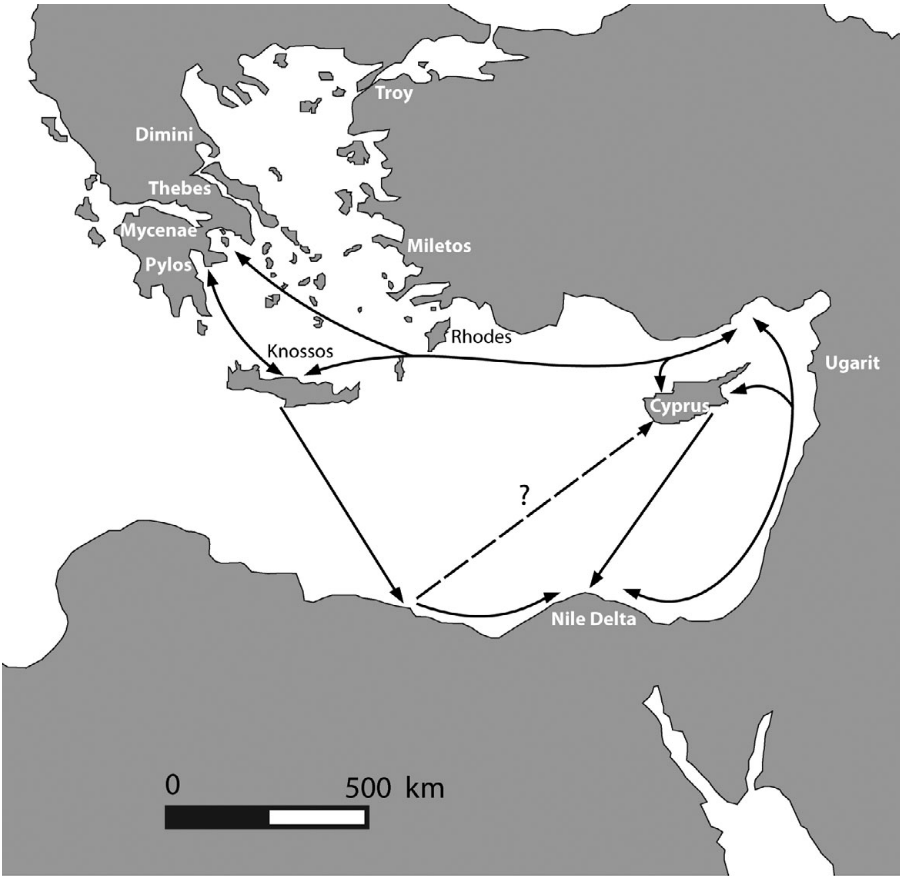
4.11 Hypothetical Aegean Bronze Age sea routes. After Papageorgiou 2009: 210, fig. 4.

and peninsulas, close to protected bays and safe anchorages," and " . . . located at crucial points on the sea lanes" (Papageorgiou 2009: 216). On a larger stage, winds and currents are generally believed to have dictated a counterclockwise motion to long-distance trade in the eastern Mediterranean in the Bronze Age (Fig. 4.12).

Yet cultural factors may have figured more prominently in the establishment and evolution of maritime connections than allowed in these reconstructions. In Chapter 3, we saw how the introduction of the sail in the Cyclades at the end of the Early Bronze Age may have initiated a reconfiguration of prominent coastal nodes and the networks they served (Broodbank 2000: 347–49). Indeed, Broodbank has injected a stronger cultural element into the formation and configuration of maritime cultural networks in the prehistoric Aegean. He maintains that the mutability of environmental conditions and social and economic relations " . . . makes it unlikely that prevailing currents and winds would determine the locations of maritime centres," and further that "[i]t is more likely that social geography in combination with technological parameters for early seafaring defined such centres and fashioned the sea-paths linking them" (Broodbank 2000: 94). From this perspective, environment, technology, and society

converged in various ways to favor or hinder maritime connections in the Bronze Age Aegean. Among the conditions motivating such connections were kinship relations; demographic needs for exogamy and labor sharing; unequal resource distribution, which presented opportunities for exchange and possibly led to "social storage" arrangements among communities to buffer against resource failure; inter-elite relations; and mutual protection against predatory raiding. This view aligns closely with Peregrine Horden and Nicholas Purcell's (2000) examination of historical interaction patterns around the Mediterranean, which reveals countless cases in which human tendencies to connection and mobility trump the ostensible constraints of topography on land and environmental conditions at sea. These connections then come to define regions of different scales and types, which are shaped as much by social as environmental imperatives. Thus, it is plainly inadequate to map maritime interactions based solely on environmental factors. It is the human response, operating within the opportunities and constraints of natural environment and socioeconomic milieu, which is decisive. Seafarers may develop innovative technologies (e.g., the sail) to alter the relationship between human and environment in their favor, or they may forge connections in spite of environmental challenges by finding ways to work around the more prohibitive obstacles. Once set in motion, maritime connections can create a cumulative history that serves to perpetuate relationships regardless of whether or not they reflect economic or environmental logic through changing times. For this reason, unraveling the history of particular connections can be revealing about how relationships among people and communities may persevere in spite of the vagaries of time.

One way to take these ideas further is to think in terms of a feedback or dialectical relationship between environmental and cultural variables, an *annales* history in which the relationships of humans with the sea, and with other humans across the sea, unfold over different scales of time and space (Braudel 1972). Building on the data discussed so far, we might propose that the parameters of seafaring involve the interplay of long-term structures of the *longue durée* (timeless circulation patterns that create the Mediterranean maritime climate, simple technologies of shipbuilding and navigation), medium-term patterns (conjunctures) of the *moyenne durée* (major climatic oscillations, technological innovations in boat construction and navigation, political and economic relationships on the scale of centuries), and historically contingent *événements* that may be single events or short-term developments (collapse of the Mycenaean palaces, colonial forays, wars, short-term climatic variations). Johan Rönnby (2007) calls these "maritime durées" and proposes that it may be possible to identify experiences and *mentalités* unique to coastal inhabitants around the world and through time, an observation that is incorporated into the concept of *coastscape*, developed in Chapter 6.



4.12 Hypothetical long-distance sea routes in the eastern Mediterranean. After Wachsmann 1998: 296, fig. 13.1.

Scale affects historical trajectories in distinctive ways. The analytical focus advocated in this book on local-scale interactions owes a debt to Horden and Purcell's emphasis on the durability of short-distance interactions among "microregions," with considerably more unstable linkages to the shifting fortunes of supraregional entities. This emphasis results in a very different history from the traditional "Great Men and Battles" version, but one that reflects more faithfully the true rhythm and full scope of Mediterranean life. One of these alternative histories can be written about short-distance maritime connections, which offer a fundamentally different view from the great interregional trading routes on which most scholarship has focused. Although rarely studied, maritime small worlds of the Aegean Bronze Age offer a window on long-lived, though not necessarily unchanging or even stable, interactions. The durability of short-distance relations results from several factors that are typically absent in large-scale, cross-cultural contacts: (1) they are easier to maintain from a practical point of view, since distances and environmental obstacles are less

inhibitive; (2) they are often founded on long-established and deeply embedded social ties; and (3) the communities they bind may be less susceptible to changing political fortunes if they lie outside the mainstream of momentous historical events. By contrast, interregional connections are more vulnerable to environmental and political forces, and are the first to be broken in turbulent times.

In effect, the analysis of maritime small worlds compresses space while expanding time. It is therefore possible to build a diachronic narrative of continuity and change in which small worlds are the focus and larger power centers and spheres of influence move into and out of view over time. The intent of this exercise is not a return to historical particularism, but rather on the one hand an interest in these people and places in their own right, and on the other a desire to assemble robust data in the service of regional-scale archaeological reconstructions, as well as comparative models that may embrace scales from regional to global (e.g., Parkinson and Galaty 2007; Wright 2004). Too often, these reconstructions and models have a flimsy foundation in data or rely on data sets that are not comparable. By building up from many well-documented local settings, we are better able to clarify their political and economic role in larger webs of interaction, and to analyze the nature and limits of influence wielded by power centers in peripheral areas (Tartaron 2010). Taking advantage of the benefits of this shift in perspective for the Mycenaean period relies on a comprehensive and interdisciplinary examination of the archaeological and environmental record.

Bronze Age Navigation in Practice: Navigational Aids

In the previous section, we established the vital nature of coastal pilotage for navigation in the Aegean. Pilotage was aided both by physical features that marked out maritime routes, warned of dangers, or promised safe haven; and by a body of maritime wisdom about them that systematized knowledge into practice. Let us first specify the aids that might have been available to Mycenaean navigators, and then consider how knowledge of their existence and use was transmitted over time.

The terminology describing navigational aids can be confusing. The terms *landmark*, *seamark*, and *skymark* would seem to indicate navigational cues existing on land, sea, and sky, respectively. This is exactly the usage adopted here, disregarding the more expansive definition of seamark that one often encounters, which includes all features that can be seen from the sea (Table 4.1). The specific combination of marks relevant to a given voyage cross-cuts these categories according to the nature of the travel: long distance or short run; day or night; coastwise or open sea; planned or opportunistic journey; familiar or unfamiliar routes; friendly or hostile waters; fair or foul weather. A local trip

Table 4.1. Navigational aids potentially available in the Bronze Age. Artificial constructions are shaded.

Land	Sea	Sky
Mountains	Islands	Stars
Cliffs	Shoals	Sun
Other distinctive topographic shapes	Protruding rocks	Cloud types and formations
Striking colors of rocks, vegetation	Wave patterns	Wind direction and speed
Beach strands	Water color	Smoke (natural fires)
River mouths	Water odor	Smoke (settlement or signal fires)
Settlements	Seabirds	
Towers, cairns, tomb mounds, and similar	Fish species	
	Breakwaters, jetties, mooring posts, and similar	

from one coastal community to another might require knowledge of only a few coastal hazards and landmarks, while a voyage of some length could involve a great many of these navigational marks and a much greater store of knowledge and navigational skill. A sea captain leading a Mycenaean trading mission from the Argolid to Knossos on Crete would have called upon his knowledge of winds, currents, islands, and celestial bodies, as well as a solid knowledge of Cretan coastal topography, wind conditions, and coastal settlements.

Landmarks

Mountain ranges or peaks with distinctive shapes served as good general markers for staying on course, since they were visible from great distances. For more precise delineation of routes, however, sea cliffs and headlands were particularly useful. In historical times, as recorded by Strabo and others, prominent headlands functioned as nodes in longer journeys conceived in terms of multiple headland-to-headland segments (Morton 2001: 186–88). Thus, one such voyage in the northern Aegean was defined as a series of headlands (Poseidonion, Sepias, Kanastron, Nymphaion, Akrathos) separating the intervening gulfs (Maliac, Thermaic, Toronaean, Singitic, Strymonic; Strabo, *Geographica* 7.fr. 32). Because of their high visibility and vital role in seafaring, headlands have been favored locations to place various kinds of manmade landmarks meant to be seen from the sea. As early as Homer, conspicuous burial mounds were placed on headlands at the Dardanelles (for Patroclus: *Iliad* 7.85–91) and at Circe's island (for Elpenor: *Odyssey* 11.71–78). An archaeological example is the erection of large cairn-like structures, which may have taken the form of tall towers before their collapse over time, on high coastal ridges of the northeastern Peloponnese in EH II (Tartaron, Pullen, and Noller 2006; Tartaron et al.

2011: 626). Such structures could have been fitted out as lighthouses or signal stations, but this is mere speculation. Apart from their potential as conspicuous landmarks, the monumentality of their construction may have warned off those with hostile intent. Whatever the original motivation for constructing mounds, cairns, or in later times, temples on coastal promontories, they served both to advertise and to provide useful navigational markers to passing vessels. In certain periods of particular orientation to the sea, for example EH II and LH III, settlements might be found on coastal promontories, but it was often not practical to settle on them, sometimes for reasons of defense, but more often due to untenable distances to water and arable land. Nevertheless, promontories are primary locations to search for traces of ancient structures related to maritime activity.

Many coastal promontories or sea cliffs were distinctive for their unusual shapes or striking colors. In historical times, these were defining properties of such topographies, giving rise to place names incorporating colors (e.g., *leukos* for white, *melanos* for black, *erythros* for red) or animal shapes (e.g., *Kynosoura* for dog's tail, *Onougnathos* for ass's jaw). A crystalline limestone sea cliff, shining brilliant white in the sun, could be a striking and easily recognizable marker along a sea route; the pervasive limestone geology of the Greek mainland explains the widespread occurrence of forms of *leukos* for coastal landforms. Naming prominent features along a route transformed space to place; once a place is named and described, it becomes part of the known world and thus less terrifying than a vast, unfamiliar sea. Regrettably, for the Bronze Age we have only the place names from the Linear B tablets and a few other likely Aegean toponyms from Egyptian and Hittite sources. Of these, only a few belong demonstrably to coastal locations and none seems to refer to an evocative coastal landform.

Of crucial navigational importance were the coastal features that pointed toward safe haven, supplies, and trading or raiding opportunities. Long beach strands, river mouths, estuaries, and embayments formed a constellation of potential stopping-places en route, but these landmarks had to be supplemented with knowledge of the characteristics of the shallows to be negotiated to reach them. Human settlements were situated in many of these places, visible in the structures of buildings, walls, roads, and cemeteries; the disposition of their inhabitants toward visitors from the sea had also to be taken into account.

Seamarks

Like mountains, islands aided in keeping a ship on course, and literary evidence from Homer forward portrays navigators steering by keeping specific islands to port or starboard. Islands, of course, possess features both of landmarks and seamarks; all the landmarks enumerated above could be found on islands. Yet a

long maritime tradition beginning with Homer characterizes islands as objects protruding from the sea that often possess a capacity for motion or floating not attributed to continental land masses.

On the open sea, wave patterns, driven by sea currents and winds, indicated general direction as well as developing weather conditions. While land was still out of sight, observations of fish could distinguish deep-sea from shallow-water species, and sightings of seabirds might permit an estimate of their typical ranges from land. Upon reaching inshore waters, to avoid danger crews had only a sounding lead or pole as an instrument to augment the information they could collect visually and their prior knowledge of local bathymetry and topography. Visual indicators of submarine features included breaking and deflected waves, protruding rocks and shoals, and water color and odor. Waves breaking far from shore indicated a shallow approach and the need for caution to avoid running aground on a shelf or invisible rocks. Changes in water color, typically from deeper to lighter shades of blue, indicated movement into shallower waters, as did the odor of waters permeated with coastal sea plants and animals, and often commingled with fresh water from estuaries, river mouths, and springs.

Human constructions on the sea, including breakwaters, jetties, and mooring posts, were recognizable infrastructural elements of harbors in ancient times. Yet it remains to be demonstrated that Mycenaeans built any of these, in contrast to the built features of contemporary Egyptian or Mesopotamian river harbors, or even the near-shore ship sheds that the Minoans built at Kommos and other sites (Shaw 1985; Shaw and Shaw 1999; see Chapter 5). Nor is there any indication that buoys or other channel markers were used in the Bronze Age.

Skymarks and Celestial Bodies

In addition to the use of the sun and stars for navigational purposes, as argued above, other celestial signs were available to aid Bronze Age mariners. Wind direction could be matched to known regional or local winds to ascertain general orientation, and wind speed might portend heavy seas or oncoming gales. Darkening skies and clouds were also important indicators of impending conditions at sea. The sudden disengagement of low-lying banks of clouds from the summits of islands and coastal mountains may portend strong winds or gales (USNHO 1952: 12). On Crete, the summer meltemi is often heralded by "a fleecy bank of white clouds" enveloping the summit of Psiloriti and neighboring peaks (USNHO 1951: 116), and further west the appearance of "long black, sausage-shaped" clouds over Cape Drepanon in winter is a sure sign of the onset of a heavy southeastern gale, accompanied by rough seas and a long, heavy swell (USNHO 1951: 139). Sometimes, these massive banks of clouds pointed toward land masses that were not yet visible.

Smoke from fires of diverse origins might also come into view before land was sighted. Forest fires of natural origin occur periodically, as part of a healthy cycle of vegetative death and regeneration. Anthropogenic fires associated with settlement activities included cooking and heating at the domestic hearth, burning in agricultural fields and pastoral complexes, and industrial activities such as pottery firing and metal working. Accidental fires at settlements were also common, set off by lightning or the careless handling of an oil lamp. Signaling by fire or smoke or even the use of rudimentary lighthouses set up on cairns was possible in the Bronze Age but there is no evidence of formal lighthouses in Greece until the late Classical period (Mark 2005: 160; Morton 2001: 212). The use of fire for everyday activities was inevitable and must have made it difficult for any coastal settlement to conceal itself behind a ridge or in a hidden valley.

Phenomenology of the Voyage

To our knowledge, Bronze Age navigators did not possess maps and charts, so how then can we describe the mental process of the voyage? Often, the navigator is said to have carried "mental maps" or "cognitive maps" of the desired route and its features (Frake 1985; Lewis 1976; Oatley 1977). This notion has been criticized by Alfred Gell (1985) as flawed and inadequate, in an argument that is to some extent semantic, focusing on what we mean by *map*, but with interesting substantive implications. Gell distinguishes *map* from *image*: the former refers to a model of reality in Cartesian space, showing all of the possible routes and territories that could be encountered, but without the point of view of the sailor and with no particular sequence of movement indicated. Gell asserts that navigators in mapless societies do not call up cognitive versions of such all-inclusive devices (it would anachronistic to claim that they do), but rather they work from a compendium of images that constitutes a perspectival experience of the seascape. The actual mental process combines knowledge of fixed spatial relationships of landscape features (referred to by Gell as "non-token-indexical" statements or beliefs) with a constant monitoring en route of the ship's relative position ("token-indexical" statements or beliefs). For instance, "Chios is south of Lesbos" is a non-token-indexical statement (i.e., it is assumed to always be true and does not depend on where the ship is currently located), while "The ship is currently passing Chios, so it must be south of Lesbos" is a statement that may be true for some part of the journey, but depends on the ship's position relative to these fixed features. If one's final destination is Lesbos, this token-indexical determination permits decision making and the action of setting or maintaining a course to the north. Navigational success is secured by knowledge both of the fixed relationships between known places, and of one's relative position among them, and Gell views these as distinct but complementary cognitive processes.

If these relationships have a form more like a series of mental images than a Cartesian map, then the knowledge and the mental process can be described as phenomenological, experiential, and embodied, but here an important distinction must be made. Gell explicitly critiques Pierre Bourdieu's "practical mastery theory" (Bourdieu 1977: 2), an early phenomenological perspective on landscape that proved a fertile source for the development of the postmodern phenomenologies of Christopher Tilley and others (Bender 1993; Tilley 1994). Bourdieu envisions the landscape not as Cartesian map space, but as a "practical" space that constantly morphs in response to the shifting perspective of a subject moving through it. In this kind of subjective, embodied experience, there is no objectively definable landscape, but instead a myriad of landscapes – both tangible and intangible – come into being through the contingent experiences of each individual subject. Practical mastery of maritime routes would involve committing to memory a series of images of landscape features from point of departure to destination, and then linking them en route. Gell rejects this relativistic view of landscape, insisting that landforms have a reality (spatial, substantive) independent of our momentary perceptions of them. Landscape change lies in the realm of geology and other longer-term processes; the change that occurs during a sea voyage is rather our position relative to these fixed features, so we must have external, fixed reference points in order for decisions based on our relative position to make sense. In Gell's phenomenology, the navigator's mental process is to refer to a kind of non-Cartesian mental map consisting of known features in fixed spatial relationships; in order to use this information, he must "match the images produced at particular map-coordinates with perceptual images of the surrounding terrain" (Gell 1985: 282).

To this point, the discussion of phenomenology has concerned one type of voyage only, albeit a common one: the daytime route that is known to a maritime community, but sufficiently long or complex to require aids to wayfinding, such as mental maps and landscape images. The mental images that facilitated such journeys in the Bronze Age are likely to have been similar to those of later times in Homer and in the periploi of Archaic to Roman times: islands, headlands, rivers, bays, and other coastal features that functioned as nodes in segmented journeys and potential places of refuge.[4]

Yet there were several other types of sea voyages for which the mental processes and practices were quite different. One of these was the very short journey, along a coastline to a neighboring settlement or across a gulf, for which way-finding was unnecessary. Another type was the night voyage that relied on stellar navigation. Using stars and constellations to maintain general direction is much like using islands and headlands as landmarks, and this is precisely the way Odysseus was instructed by Calypso to navigate to the island of the Phaeacians (*Odyssey* 5.270–77). By contrast, the star path steering practiced by the mariners of the South Pacific is tantamount to the creation of a Cartesian

map of the heavens, which could be read like a modern road map. Finally, some voyages extended beyond the limits of the maritime world known to the navigator, as for example when a ship was blown off course or when pioneering seafarers ventured into unknown waters. In those situations, the crew had no references at all and were forced to fall back on their experience with landmarks, seamarks, and skymarks to travel safely.

Types of Maritime Communities in the Bronze Age Aegean

A fundamental assertion, which forms the basis for the archaeological reconstructions to follow, is that in the Bronze Age Aegean there were two distinct realms of maritime activity, entailing different levels of knowledge and experience. A basic, or generalized, realm of activity comprised short-distance travel not requiring advanced way-finding or environmental and social knowledge about distant locations and peoples. A broad range of fishermen, farmers, traders, and other coastal dwellers possessed the resources and skills to undertake simple trips to local fishing grounds, along adjacent coastlines, across straits and gulfs, and out to nearby islands. The risks of this kind of sea travel were comparatively minimal, and consequently harbors large and small must have been busy with small-boat, short-range activity.

A specific, advanced level of knowledge was essential for medium- and long-distance voyaging; medium distance is here defined as nonlocal, intrabasin (Aegean, Ionian) travel, and long distance as venturing beyond these basins. This was the realm of the master shipwright, the expert navigator and helmsman who commanded detailed information about seas and coastlines, and the crews trained in rowing and sailing. It was a subsociety organized in part to safeguard and transmit a body of nautical knowledge to the succeeding generation. Because such mastery was held by few, it often afforded preferential access to exotic goods, raw materials, and esoteric knowledge, and thus it could be a source of considerable social power.

Both generalized and advanced maritime knowledge persisted over long periods of time, the former largely "under the radar" of mechanisms of centralized control. The more specialized knowledge and performance of the professional mariner was of potentially great interest to centralized political entities that depended on communication by sea. Thus at Pylos, personnel and ships were co-opted by the palace, whether to form state fleets or to work as private contractors in the service of the state. Yet the political centralization characteristic of EH II or the Mycenaean palatial period must be seen as a kind of periodic interlude in the more typically loose political structure of the Bronze Age and Early Iron Age. At most times, maritime communities must have operated independently or semi-independently. In the next section, the formation and perpetuation of the maritime knowledge of these specialized communities is examined.

Transmission of Maritime Knowledge and the *Habitus* of Maritime Life

Because for all intents and purposes LBA Greek society was pre-literate, the essentials of maritime life were communicated by word and by nonverbal demonstration. Several kinds of expertise were involved: shipbuilding and repair; techniques of paddling, rowing, and sailing; knowledge of the indicators of winds, currents, and weather; and detailed familiarity with a host of principal and alternative sea routes. Mastery of this body of knowledge was neither easily obtained nor commonly held in society; it required physical skills, mental powers of memorization as well as adept thinking in difficult situations, and plenty of experience on the sea. It was a specialized life and throughout recorded history, communities of seafarers have existed in various degrees of segregation from the rest of society. These maritime "closed communities" (Muckelroy 1978: 221–25, 240–42), "ship societies" (Adams 2001: 304), or possibly in the Mycenaean case a "galley subculture" (Wedde 2005: 33–36; see Chapter 3) formed alternative social entities that did not simply reproduce at smaller scale the wider societies of which they were a part. Indeed, a maritime community might look little like its host society: it might be exclusively male, and constituted by family or kin groups specialized in maritime pursuits. Although hierarchical relationships were essential aboard ship due to the hazardous conditions of seafaring, status in the maritime community might be achieved – according to experience and skill – rather than ascribed on the basis of social class, wealth, or kinship ties (Adams 2001: 305–306). Master sailors, navigators, and helmsmen would always have high status relative to less skilled and experienced crew members, as a matter of necessity.

Historical records and ethnographic studies provide many examples of multigenerational seafaring social groups with strong incentives to maintain and perpetuate the maritime closed community. The practical problem that so much information had to be learned and experience gained could best be addressed by beginning to inculcate knowledge at a young age, within the context of the family. Maritime knowledge was worth guarding as a potential source of power and independence. In early times, those with access to distant places with their exotic products and esoteric knowledge possessed a special, perhaps even mystical, status as Broodbank (2000: 289–90) suggests for the longboat voyagers of the EBA Cyclades (see also Helms 1988). The independence of maritime communities varied with the strength and interest of the state. In the Linear B tablets An 1, An 610, and An 724 from Pylos, we learn that the palace was able to levy ships and rowers from several villages in the last months of its existence. Similarly, in Viking-era Scandinavia, powerful families ruling proto-towns were able to outfit "levy fleets" with men from surrounding farmsteads and villages (Rönnby 2007: 75; Westerdahl 1992: 10). Yet in the

Mycenaean period, and presumably in many other times and places, much of the coastline of the mainland and islands lay beyond the political reach of any palace state, and even within palatial territories, state control could hardly have been all encompassing, whether by force or accommodation. This does not imply that long-distance trade missions involving the acquisition of raw materials and luxury items from distant ports of trade necessarily lay in the hands of independent maritime communities, but short- and medium-distance social and economic sea travel must normally have carried on with little or no palatial interference. These traditions, and the connections they established, time and again outlived centralized states.

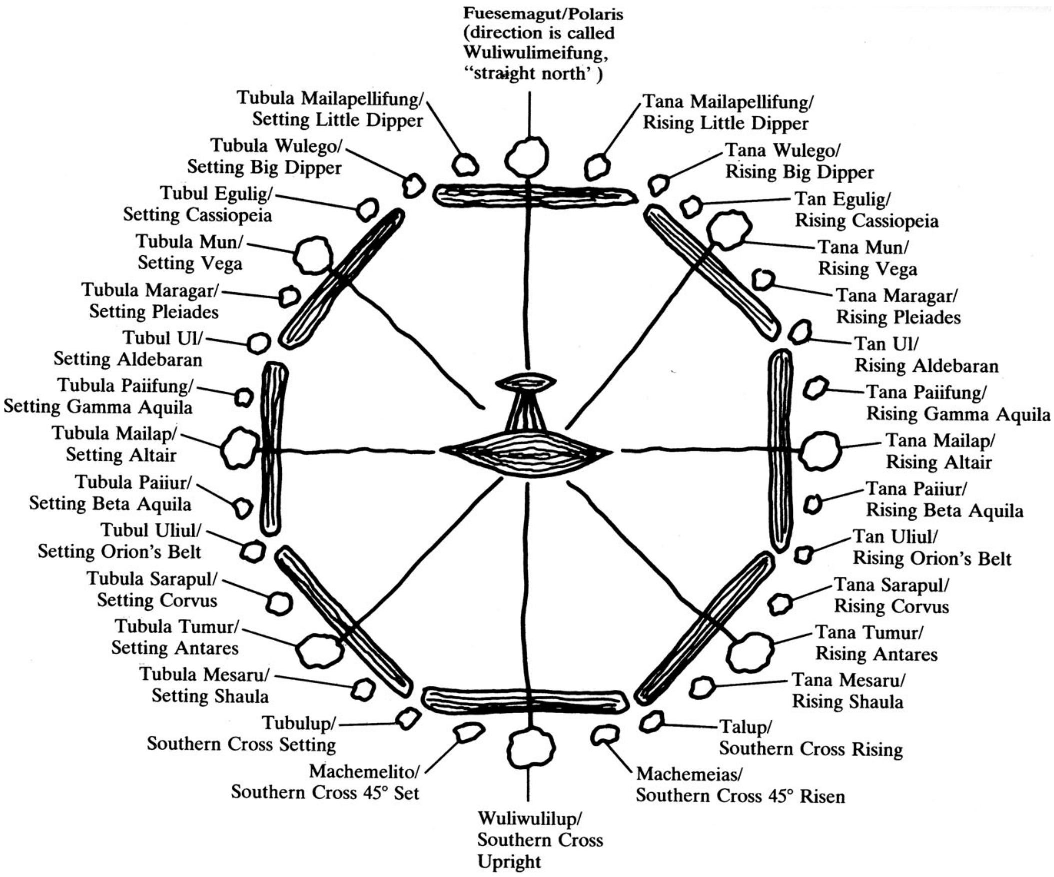
Because maritime knowledge was content heavy and complex, some means were needed to transmit a body of maritime knowledge within and across generations. Ethnographic studies of seafaring in the Pacific are a good point of departure, since they offer detailed reconstructions of maritime knowledge and its transmission in a nonliterate society. From a very young age, boys in these communities learn the basic skills of seafaring: they accompany family members on short voyages for fishing or visiting, they assist in the construction of canoes, and build toy models of them. In the Caroline Islands, youngsters begin to learn the complex system of stellar navigation through a series of game-like exercises designed to convey the key concepts and to train the mind for memorization and situational thinking. An instructional "star-structure" compass, representing the great circle of the horizon divided into 32 points where the stars are observed to rise and set, is assembled from simple materials such as stones, shells, and reeds (Fig. 4.13). Sitting together in a boathouse in the evening, experienced navigators guide novices through a set of rigorous exercises including the following (Goodenough and Thomas 1987: 5–7):

Island-Looking: In this memorization and orientation exercise, navigators drill pupils on the locations of islands by starting from an island and, moving around the compass, naming the places that lie in each direction. The exercise is then repeated starting from another island. Advanced students are able to name the locations of reefs, shoals, and other seamarks.

Sea-Knowing: In this exercise, students learn the sea lanes that lie between the islands and reefs by giving them names that refer to the rising and setting of specific stars that occur along them.

Sea Brothers: The student learns all the named sea lanes that lie along the same star compass coordinates. If a navigator forgets the star path between two islands, he may remember that the path is "brother" to another sea lane, and thus recover the forgotten coordinates.

Coral Hole Stirring: To reinforce the mastery of the star courses, this game imagines a chase sequence between a fisherman and a parrot fish. As the fisherman probes a hole in the reef at a given island, the fish darts off to a neighboring island, then another, and so on until eventually returning to



4.13 Example of a star-structure compass, Caroline Islands, Micronesia. Thomas 1987: 81. Courtesy of Stephen D. Thomas.

the starting point. Each hole has a name that substitutes for the name of the island.

With these and other exercises, aspiring navigators are initiated, in a systematic way, into the knowledge they will need to voyage successfully at sea. As they sail with master navigators, they recall this information and put the principles into practice. Some, but not all, will become master navigators themselves, responsible for transmitting knowledge to the next generation.

The community of sailors in the Caroline Islands takes on the characteristics of a closed maritime society, with selective membership and an oral tradition that is both durable and conservative. The apprenticeship of navigators and sailors (exercises, training at sea) is rigorous, with constant practice and layers of redundancy that facilitate mastery of crucial knowledge. In this way the society and its fundamental store of knowledge are faithfully reproduced and protected. The cosmology of the navigational star structure, and the alternative names for islands and sea lanes, are part of an esoteric seafaring lore known only

within the group. This lore also incorporates stories with practical and moral lessons, which are embedded in chants that are structured, metrically and tonally, to aid in memory recall. The meaning of the chants is often cryptic, and only learned with the interpretive commentary of a teacher. The settings for this instruction are special places (the boathouse, at sea) exclusive to the maritime community. Because sea travel is at once both essential to island life and yet formidable and often perilous, master navigators are also ritual specialists who communicate with spirits of navigation, observe taboos, and perform rituals to ward off dangers at sea.

To place these ethnographic observations in a more general and time-transgressive model, Bourdieu's concept of *habitus* (Bourdieu 1977, 1990) is a useful way to frame the process by which maritime social groups and their knowledge are perpetuated. This is so because habitus explains how and why traditional lifeways are reproduced and preserved over long periods of time, while at the same time mediating between the extremes of determinism – that is, that human perceptions and practices are determined by pre-existing structures over which people have no control – and voluntarism, which accords humans unfettered freedom to make choices that shape the conditions of their lives.

According to Bourdieu, the habitus is a system of dispositions in an individual or social group toward conceptions, activities, or behaviors that are structured and perpetuated by a "present past" of similarly structured practices and worldviews (Bourdieu 1990: 53–55). In other words, each generation inherits a durable structure that defines the parameters of thought and action in which it can operate, and within which practice is ultimately generated. The habitus is not defined by explicit laws, but instead by the unconscious adherence to these inherited structures. Bourdieu did not view the habitus as a purely determinative mechanism in which individuals and groups are without choices, however. Instead, there exist " . . . an infinite number of practices that are relatively unpredictable"; nevertheless, freedom to choose is not actually unlimited because " . . . the habitus tends to produce all the 'reasonable,' 'common-sense' behaviors (and only those) which are possible within the limits of these regularities" (Bourdieu 1990: 55).

To many observers, Bourdieu's actors possess too little agency, leaving insufficient scope to account for innovation ("creation of novelty": Bourdieu 1990: 55) outside the bounds of inherited knowledge, particularly internally generated change as distinct from that which is externally stimulated or enforced. An alternative viewpoint is expressed in the "structuration theory" of Anthony Giddens (Giddens 1979, 1984; Nakassis 2006: 19–23), which posits a different relationship between structure and agency. Giddens envisions structure and agency as forming an inseparable duality. Although individuals and

groups are undeniably shaped by the durable structures they inherit through no choice of their own, actors are knowledgeable, able to make conscious choices that are not only unconstrained by the limits of the habitus but that also may reshape it. Conscious choices need not have intended or predictable outcomes; they often lead down contingent paths to changes that could not have been predicted and for which the chains of agency are known only in hindsight. In this manner the elements of structure – traditions, worldviews, practices – interact with agency in a dynamic process of continuity and change, of mutual shaping (Giddens 1984: 14). A simple example is linguistic change: language is a dynamic structure in which everyday speech reproduces inherited syntax and semantics, but also introduces changes that one day may be additions to, or modifications of, the structure of language (Nakassis 2006: 21).

The habitus, in Bourdieu's sense, aptly describes the power of tradition and the conservative maintenance and transmission of maritime knowledge over long periods of time. This is particularly the case because maritime communities depended on the effective reproduction of large bodies of specialized knowledge to protect their lifeways and in a literal sense their very lives. Their habitus cannot have been overly rigid, however, because adaptation and innovation were equally essential to their survival. To continue the ethnographic example, elements of innovation are evident among the Caroline island navigators. Often, a master navigator died before imparting to his pupils his full commentary on seafaring lore, leaving them to develop their own interpretations based on the knowledge they had managed to acquire as well as their personal experiences. The new versions were frequently "quite different from the original and yet still workably consistent with reality" (Goodenough and Thomas 1987: 13). Further, there is a tendency for navigators to elaborate on the lore in displays of virtuosity. Some individuals voyage to more distant places along star paths to discover islands previously unknown, which they may equate with previously mythical places. It is also the case that Caroline islanders have adapted to the availability of new materials and sailing (including navigational) equipment from the West. Some new knowledge can be accommodated within the existing habitus, for example, by fitting newly discovered places and new commentaries into the dynamic, living lore. Technological change, particularly that initiated by contact with the West, may precipitate deeper structural changes, and the fate of the traditions of the maritime communities of the Pacific – their habitus – is far from clear in the twenty-first century. Yet the recent history of the Caroline Island navigators amply demonstrates a closed maritime community striving, both consciously and unconsciously, to perpetuate and protect their habitus, while also creating and making choices about information that pushes beyond the bounds of their inherited structures.

Mycenaean Maritime Communities

We ought now to ask whether we can detect maritime communities in the Mycenaean world possessing a specialized body of maritime knowledge. There is little direct evidence for them, though it is possible to make certain inferences from indirect evidence, and from what we know of maritime communities of other times and places. There are certain general statements we can advance, for example that the nautical life involves specialized skills and occupations. Shipbuilding and maintenance, navigation, and even rowing and other crew duties all require experience and advanced skills, which must have been transmitted through a system of master–apprentice relationships. A consistent conclusion drawn from recent trials of replica ships – from "Neolithic" reed boats (Tzalas 1995b), to Bronze Age galleys (Severin 1985, 1987), to the reconstructed trireme *Olympias* (Rankov 2012) – is that an inexperienced crew requires a long apprenticeship before it can properly propel and control an unfamiliar vessel. The triremes of the Classical Athenian navy were manned by professionalized crews of free citizens, metics, and foreign mercenaries who practiced during peacetime (Hale 2009); a similar program of training may have been followed by the captain, helmsman, and rowers of the Mycenaean galley.[5]

It may be possible through archaeological means to identify the coastal habitations and workplaces of maritime communities, but this remains a challenge because so few harbors, at least of the Mycenaean period, have been recognized and studied. This topic will occupy much of the remainder of the book. For now, let us explore how the early Greeks represented their maritime pursuits in word and image, through the Linear B tablets, iconographic images, and the later Homeric epics, particularly the *Odyssey*. In these sources, we might recognize the bare outlines of a maritime *durée*, of persons in action or a persistent *mentalité* expressed in words.

Linear B Evidence

It is worth recalling that the Mycenaean galley was the largest and most technologically advanced machine of its time, and the resources and organizational capacity of the palaces may have been required to build and maintain a galley fleet. Although it is uncertain how extensively Mycenaean ships traveled around the Mediterranean in pursuit of trade and diplomatic missions (see the discussion in Chapter 2), certain materials, particularly metals, were imported from overseas and controlled carefully by the palaces. The Linear B tablets from Pylos provide compelling textual evidence for palatial oversight of building, finding crews for, and sailing ships, at least in Messenia (Palaima 1991: 284–86). The personnel drafted for these tasks are listed or named. Shipbuilders (*na-u-do-mo*) are mentioned on two tablets at Pylos. On Vn 865, *na-u-do-mo* is the heading

of a list of 12 names, each followed by the numeral 1, probably indicating 12 shipbuilders assigned to construct one ship each. On Na 568, a group of men with this title is recorded with a single place name and an exemption of 50 units of flax while they are supervising construction. The title *e-re-e-u*, found on several tablets at Pylos, seems to refer to an official in charge of rowers. The rowers themselves were recruited from a number of coastal towns, apparently as part of an annual levy organized using the same principles as Mycenaean taxation; they performed their services in exchange for land use rights (Killen 1983). The association of at least one of the absent rowers on tablet An 724 with the *lawagetas*, a military leader, suggests that these records refer to a military, rather than commercial, fleet.

At least seven names occurring in the Linear B archives at Knossos and Pylos derive from roots associated with maritime activities, translatable as "Ship-Famous," "Fine-Ship," "Swift-Ship," "Ship-Starter," "Shipman," "Fine-Harborer," and "Fine-Sailing" (Palaima 1991: 284). Intriguingly, however, the men with these names appear mainly as herders, as well as two bronze smiths at Pylos; none is recorded pursuing a maritime activity. One way to interpret the lack of correlation between name and occupation is that as the palace states reorganized and consolidated their economies, workers from across the economic spectrum were co-opted to the large, palatially controlled industries, including metallurgy and other craft manufacturing, and the production of wool on Crete and linen at Pylos. One of the political consequences of economic restructuring by Minoan and Mycenaean states tended to be that traditional ties between communities and their landscapes and subsistence practices were severed (Haggis 2002). Even so, skilled seamen would have been prime candidates for the annual levy of rowers. We might imagine that many such names existed among members of specialized maritime communities throughout the Mycenaean world; on the other hand, these could be very old names that had long since lost any exclusive association with the original occupation, much as names like Smith, Miller, and Carter have done in English-speaking countries today.

The Linear B scribes did not concern themselves with localized coastal activities such as fishing, presumably because the palaces had neither the interest nor the ability to exert direct control over a ubiquitous resource with little potential for profitable specialization. Products of the sea must have been widely available in local markets, and the palace may have used agents or other means of acquiring them as needed. The practices of fishing and short-distance voyaging for social and economic purposes must have continued, both within and beyond the palatial territories, without hiatus during the Mycenaean period. In other words, these traditional activities tend to persist regardless of the vagaries of political organization.

The matter, discussed in Chapters 2 and 3, of whether maritime commercial activity was carried out in state-controlled ships or commissioned to private

merchant vessels that may have been partially or fully independent of the palace, is unlikely to be resolved soon, barring the discovery of a series of tablets that explicitly addresses overseas trade. The same may be said for Wedde's (2005) argument from the Pylos tablets that a "galley subculture," composed of captains, helmsmen, and rowers, arose on the Messenian coast to challenge the authority of the palace in LH IIIB (Chapter 3). This is one plausible interpretation of the apparently ominous circumstances under which rowers were recruited in one document (made up of tablets An 657, 654, 519, 656, and 661) bearing the heading, "Thus the watchers are guarding the coastal regions" (Chadwick 1994: 173–79). Whether the galley crews helped to topple the palace, or instead came to the aid of the palatial elites in a time of grave danger (Wachsmann 1999), we may infer minimally the existence of a seafaring community with specialized, highly valued knowledge and skills – helmsmen and navigators being most obviously in demand. To what extent that community operated independent of the palace, we cannot say with certainty, but we can propose with some confidence that the state controlled some aspects of seafaring – such as military operations and long-distance trade – while leaving the rest in private hands. Thus, the Linear B archives do not offer an unambiguous portrait of a maritime community, but the pattern of palatial political and economic interests revealed in the tablets points to an aggressive but limited oversight of nautical affairs, leaving much room for traditional coastal activities.

Iconography

The Flotilla Fresco at Akrotiri, depicting a range of ships and boats, gives some sense of the complement of vessels one might see in a busy Bronze Age harbor. The small rowed skiff W622 seems to play the role of pilot, but must have functioned just as well as a fishing boat or short-distance coaster. The fragmentary but contemporary fresco from Ayia Irini, Kea (W672–676), shows either crews or harbor personnel walking on shore and mixing something in large, tripod cauldrons. Behind them is an ashlar building that suggests parallels with the possible ship shed on the north wall of Room 5 of the West House, as well as the foundations of ship sheds known archaeologically on Crete. In the frescoes, a visual distinction made between the crews, dressed only in loincloths, and the honored guests, who wear elaborate robes, emphasizes the difference in status between elites and non-elites. A recent interpretation of the Flotilla Fresco views all these men, seamen and foot soldiers alike, as members of a victorious warrior "coalition": "soldiers, priests, sea captains, and lowly paddlers – whose membership in hierarchical but cooperative coalitions ensures island power" (Chapin 2007: 142).

These glimpses into maritime life in the cultural sphere of the Minoan palaces of the neopalatial period may serve as a bridge to Wedde's Mycenaean galley

subculture. Wedde traces these groups, and with them a continuity in the traditions of seafaring, into the EIA through the iconography of the galley, which peaks in LH IIIC and persists with only gradual modification in the EIA. This continuity may be seen as a strong indication that seafaring communities and their traditions survived intact despite the collapse of political centralization.

Homeric Epics

The commission of the Homeric epics to writing postdates the fall of the Mycenaean palaces by more than 400 years, but as the oldest examples of Greek literature they are closest in time to the events of a distant past about which the poet sings. Furthermore, the *Odyssey* is, at least superficially, a seafarer's tale. Although it is well established that Bronze Age survivals in Homer are few (Bennet 1997; Finley 1978; Raaflaub 1996), it might be possible to recognize a *mentalité* or elements of a maritime habitus that persisted from the LBA into historical times.

Seafaring is not glorified in Homer. Rather, heroes like Menelaus, Nestor, and Odysseus emphasize the ardor, the danger, the terror, and the loss of life at the hands of malignant forces of nature and implacable gods and monsters. The *Odyssey* abounds in stories of ships blown off course, stranded in windless seas, or wrecked altogether. A recurring theme is that these disasters are visited upon crews that have offended a powerful god in some way. The audience listening to a bard singing these tales could not fail to grasp the implication that seafaring was not for the faint of heart or for the uninitiated. Many would have had personal knowledge of a ship or a person lost at sea.

In the *Odyssey*, there are three main groups of sea travelers: warrior-heroes and their followers, pirates, and merchants. They are distinguished on the basis of who they are – their status and social identity – rather than on their actions at sea, because their realms of activity – war, trade, and raiding – overlap to a surprising extent. As we have seen, the Trojan War heroes often acted as pirates do, plundering coastal regions for needed supplies or treasure. They also were the beneficiaries, if not the actual agents, of long-distance trade for raw materials and other exotic commodities (Tandy 1997: 75). Pirates pursued organized, "informal" warfare, and their ships and crews must have been fitted out to wage war. Merchants, too, might raid when the opportunity arose.

Odysseus and the rest of the Trojan War heroes formed an elite warrior class that ruled small, dispersed chiefdoms, more analogous politically with an emerging aristocracy of Homer's time – the *basileus* and his followers of the eighth century – than with the rulers of the Mycenaean world. In Homer, the social and economic structure was based on the *oikos*, consisting of the extended family (usually three generations living together) and its land, animals, slaves, and all other assets. Ships were owned by prosperous families, whose patriarchs could

assemble a crew from among the dependants of the *oikos*, or hire them from elsewhere. This world is more similar to Viking-era Scandinavia (Rönnby 2007) than to the Mycenaean palatial era.

Eighth-century basileis, like their epic counterparts, constructed and maintained their status by differentiating themselves from the rest of society by means of what David Tandy (1997: 141–65) terms "tools of exclusion." The most prominent of these devices were inter-elite, reciprocal hospitality and gift-giving; councils and feasts; hero cult and warrior burial; and indeed the epics themselves, which can be seen as part of the program of elite self-definition and exclusion (Tandy 1997: 141, 152). A detailed treatment of this program is beyond the scope of the present work (for different perspectives, see Antonaccio 1998; Morris 1987, 1998; Osborne 1996: 70–136; Tandy 1997; Whitley 1991), but a few examples from Homer and from the archaeological record give a sense of it. Telemachus receives a lavish reception at Pylos and Sparta once he is recognized as the son of Odysseus, and thus as a member of the elite warrior class. His arrival at Pylos interrupts a great feast at the seashore for which 81 bulls were sacrificed to Poseidon (*Odyssey* 3.1–10), obviously well beyond the resources of all but the wealthiest of men. The audience halls of Alcinous, Odysseus, Nestor, and Menelaus find parallels in several large buildings on the Greek mainland and islands (Mazarakis Ainian 1997: 363–67; Tandy 1997: 144–49). Beginning in the later eighth century, cult places dedicated to epic heroes, including the Menelaion at Sparta and possibly shrines to Agamemnon at Mycenae and Odysseus on Ithaca, ". . . paralleled social display and epic poetry as means of legitimating social and economic inequality . . . [t]he cults of epic heroes can be seen as part of that ideology: their worship confirmed social realities for those in power, who claimed them as ancestors" (Antonaccio 1998: 64). For the Homeric leaders, long-distance maritime travel was an essential contribution to the identity of the warrior-chief: to prove one's mettle by warring and raiding in distant lands, to procure exotic material and objects whose possession conferred status, and to establish alliances with other elites.

Those who could be identified as merchants did not belong to the elite class. Homeric heroes display ambivalence toward trade for profit, which was generally left to professional merchants and, especially, Phoenicians. At one point a Phaeacian youth insults Odysseus' fitness for (elite) athletic competition by saying, "You look more like the captain of a merchant ship, plying the seas with a crew of hired hands and keeping a sharp eye on his cargo, greedy for profit" (*Odyssey* 8.161–64). In Hesiod's near-contemporary *Works and Days*, a common farmer could take up sailing for part of the year in order to sell his produce for profit (*Works and Days* 619–94).[6] There is no reason to believe, however, that elites of Homer's time did not participate in trade voyages, particularly those involving gift exchanges or luxury materials and products. The apparent disdain of trade among the Homeric heroes may be a bit

of aristocratic dissimulation aimed at creating social distance from professional merchants.

The sea tales in the *Odyssey*, the gods, monsters, and natural hazards that Odysseus encounters in his wanderings, are a potentially rich source of information about ancient attitudes toward the sea, but they are notoriously difficult to interpret. Is it possible to find in them traces of a more ancient maritime lore? One way to interpret these stories is as mariners' tall tales, plucked from hoary oral tradition and rendered increasingly fantastical with retelling over time. Exaggeration and dissociation from reality may reflect a combination of conditions inherent to both early seafaring and oral tradition. The terror of encountering storms and hostile natives in uncharted waters would provide a source of vivid recollections and dire cautionary tales. Exaggeration might serve several purposes: the enhancement of a good story; the use of hyperbole to impress upon the listener a visceral sense of danger, whether in a didactic or performative context; or as a way to maintain the secrecy of routes and places by distorting their locations and inflating the hazards associated with them. All manner of anecdotes could be believable given a hazy knowledge of some part of the world. In the *Odyssey*, once the action moves from the Aegean and eastern Mediterranean westward into the central Mediterranean, places and characters shift from the real and identifiable (e.g., Pylos, Sparta, the Nile River) to an unreal world of monsters, goddesses, and the realm of the dead. The commission of the Homeric epics to writing occurred just as the colonizing movement west to Sicily and Italy was underway; the origins of some of the sea tales in the *Odyssey* might be traced to the imperfect knowledge about these new worlds.

It is also plausible that these stories contain elements of phenomenological itineraries full of periplus-like sailing directions, mnemonic devices for recalling details of long voyages, and cautionary tales told in metaphorical and possibly encoded terms. If we imagine the Greeks trying to come to grips with new lands and essentially uncharted seas in the eighth and seventh centuries BC, several fragments of sailing instructions can be recognized in the *Odyssey*: (1) segmented journeys from headland to headland and island to island; (2) storms and gales with realistic effects and reactions by Odysseus' crews; (3) coastal hazards including narrow passages and submerged rocks and coastal shelves; (4) rough seas with currents, waves, whirlpools, and eddies; and (5) potentially hostile natives. Naming and animating these people, places, and forces of nature in the form of narrative stories served practical purposes. They were incorporated into a vital body of maritime knowledge as mnemonic devices to aid in the recognition of a route and the hazards that lay along it. Naming and describing transforms unknown to known, and begins the process of domestication of an unfamiliar part of the world.

It is not particularly useful in the present context to try to chart Odysseus' route or to identify the places where he encountered gods and monsters, as

so many "Homeric geographers" have done (e.g., Bérard 1927–9; Bradford 2005; Severin 1987; Stanford 1947). To a bard's audience, any explicit association between the fantastical places and characters inhabiting locations beyond the familiar geographical realm and real-world routes and inhabitants would be meaningless detail. The epics are not geographical treatises, after all, and although the audience would expect some adherence to what they knew of the world and the Trojan War story, much of the entertainment value of the performance was in being lifted out of the here and now to journey to times and places literally out of this (i.e., the audience's) world.

Thus, instead of trying to match epic elements to the real world, it makes sense to think of Odysseus' encounters as representative of universal experiences at sea. The proximal impetus for some of the stories might have been the colonizing effort in the central Mediterranean and northern Africa, but the pattern of their construction may be much more ancient. To cite a few examples, the "Clashing Rocks" that appear in the *Argonautica* (the myth of the voyage of Jason and the Argonauts) are often identified with the mouth of the Bosporus, the entrance into the Black Sea (Apollonius Rhodius, *Argonautica* 2.555–606). These two floating masses of rock crashed together whenever a ship tried to pass between them, demolishing the ship and its crew. The origin of this story may lie in the difficulty of passing from the Dardanelles through the Bosporus into the Black Sea, because of the combination of prevailing northerly winds and the strong current of the Black Sea outflow. Ships could only make headway by waiting for a strong southerly/westerly wind to propel them against the current.[7] The danger of being driven against the rocks if the wind failed may have prompted the story of the clashing rocks, but it is easy to see how such an apparition could be inspired by any turbulent narrows. A distinct but similar obstacle, the "Wandering Rocks," was encountered both by Odysseus (*Odyssey* 12.61–72) and Jason (*Argonautica* 4.785–88). Similarly, Charybdis, the personification of a treacherous whirlpool, was encountered by these two heroes (*Odyssey* 12.235–44; *Argonautica* 4.920–60). It may be significant that once the heroes passed safely, these dangers were effectively neutralized: once Jason had passed between the Clashing Rocks, they became fixed in place (*Argonautica* 2.606–607); and the Sirens were said to have committed suicide after they failed to entice Odysseus to shore. These resolutions may be metaphors for successfully incorporating these hazards, and the means to overcome them, into the knowledge system of the maritime community.

Into the monstrous appearance and practices of the creatures with whom Odysseus and his men came into contact can be read assorted fears about hostile indigenous people. Again and again, they met inhabitants living in incomprehensibly un-Greek ways, from the Cyclopes who lived in isolation from one another and failed to take any account of the rich agropastoral and maritime potential of their offshore island (*Odyssey* 9.116–39), to the horrific cannibalism

of Scylla, the Cyclopes, and the Lystraegonians. Cannibalism is a virtually universal taboo, which throughout history has been falsely projected by colonizers onto indigenous people, out of ignorance, fear, or a need to regard them as less than human (Biber 2005; Clemmer 1996; Obeyesekere 2005). False or exaggerated representations of the "other" in seafaring lore served to underscore the caution necessary when making incipient contacts with people in the absence of a common language or customs. These concerns were often justified.

Could some of these elements be much older than the period of westward colonization? Richard Martin argues that the *Odyssey* tells of the end of a heroic tradition; the poem and its characters speak to a vanishing past from a diminished present, and for Iron Age bards performing the tale this heroic age was that much more remote (Martin 1993: 240; Murnaghan 2002: 140–41). In the *Odyssey*, the Trojan War heroes are now dead or returned home to relatively uneventful lives with no comparably heroic successors in sight. Among the lost traditions was adventure on the boundless sea, and hard men like Odysseus who embraced both its peril and its magic. The death of the old maritime tradition is signaled when the Phaeacian ship returning home from conveying Odysseus to Ithaca is turned into stone by an angry Poseidon (*Odyssey* 13.125–83). With this act, the maritime life of these consummate seafarers is "fossilized" and passes into the past.

We may bring this discussion back to the Mycenaeans by noting the strong evidence that Mycenaean ships had already arrived in the southern Italy and Sicily at the beginning of the Mycenaean period, by LH I if not a little earlier. They, not the Minoans or the colonizers of Homer's day, were the Aegean pioneers in the region. How did they assemble the information they needed to make the voyage safely, and how did they structure knowledge to instruct and transmit it across generations? I submit that the process must not have changed much over the centuries, and that fragments of maritime lore embedded in the *Odyssey* were probably drawn from much older traditions of building phenomenological itineraries and structuring narratives of exploration. Obviously, in any long-lived oral tradition there is a process of selection and updating of material that prevents us from retrojecting stories directly and literally back to Mycenaean times. Nevertheless, the *Odyssey* and other early Greek literature, when examined alongside archaeological and ethnographic evidence, can contribute to a better understanding of the cognitive and practical process of building and maintaining maritime knowledge over periods of centuries.

Conclusions

The environmental conditions of seafaring in the Aegean area are complex outcomes of earth processes in nested scales from global to local. These interactions create patterns of climate, weather, currents, and winds, which are in turn

influenced by the Aegean's unique geographical position and topographic configuration, with its profusion of islands and deeply indented coastlines. These parameters undoubtedly shaped the development of maritime life in the Bronze Age, but social factors were also crucial in the formation and maintenance of maritime connections, sometimes in the face of environmental obstacles.

Because of the relatively small scale of the Aegean Sea and the dense packing of islands within it, navigation involved coastal pilotage to a much greater extent than open-sea navigational techniques. Two distinct levels of seafaring expertise existed: a general level sufficient for local fishing and short-range travel to nearby coasts and islands; and a specialized, sophisticated knowledge of environmental conditions, navigational techniques, routes, and distant places for medium- and long-range travel. A landlocked farmer like Hesiod with a basic knowledge of seamanship could make short sea crossings to trade his wares. The professional seaman engaged in longer voyages, on the other hand, drew upon a complex store of maritime knowledge. Such knowledge was systematized within a discrete maritime community as a body of lore, the transmission of which involved hands-on training, formal sailing instructions, and vivid, metaphorical narratives designed as mnemonic devices and in-group esoterica. Because this information was communicated orally, it would not be expected to survive in the material record, but the early Homeric literature may preserve traces of this lore, and ethnographies of modern low-technology seafarers offer enlightening insights into the structure of maritime communities, the content of their knowledge, and the mechanisms of its transmission. The combined evidence of texts, iconography, and archaeological materials shows that maritime communities and their specialized expertise survived relatively intact through stable and unstable periods.

It is now time to address a problem outlined in Chapter 1: Where are the Aegean harbors and landfalls of the LBA, and why do we know so little about them?

FIVE

COASTS AND HARBORS OF THE BRONZE AGE AEGEAN

CHARACTERISTICS, DISCOVERY, AND RECONSTRUCTION

For all the indications that sea travel was fundamental to the Mycenaean political economy, we have little evidence for their coastal anchorages, let alone developed harbors or port towns, in the Aegean. We must ask why this is; what, if anything, we can do to recover and investigate them; and why we should want to do so in the first place. These questions form the focus of this chapter.

To tackle the last question first, the importance of identifying *specific* landing sites instead of merely characterizing the *types* that would have existed on Bronze Age Aegean coasts (e.g., Morton 2001: 6–7) must be established. Many anchorages will have been small, susceptible to alteration over time, and not necessarily accompanied by a settlement or a conspicuous artifact scatter. Is it worth the time and effort to search for them? Surely it is if we are serious about understanding the networks of interactions by land and sea that amounted to the connectivity of daily life, particularly if, following Horden and Purcell (2000: 123), our aim is to reveal " . . . the various ways in which microregions cohere, both internally and also one with another – in aggregates that may range in size from small clusters to something approaching the entire Mediterranean." Only by knowing the locations of the coastal nodes in these networks can we fully make use (and sense) of archaeological data bearing on interaction at all scales.

Dedicated harbors as well as anchorages used only intermittently or opportunistically must have been abundant in many regions during Mycenaean times, both because of the morphology of the Greek coastline and because they were needed. As communication by sea expanded, a multitude of anchorages, large and small, was required to ensure that voyaging was as safe as possible, and to facilitate economic and social relationships. Ship captains needed access to safe anchorages to shelter from winds and storms, to procure provisions, and to enter

into various kinds of transactions, including trading and raiding. Running out to sea to escape a storm was a maneuver of last resort; to seek a coastal haven was much preferred. At times, ships and their crews were forced to wait for favorable winds, and this could occupy days or weeks during which their needs for sustenance would have to be met. The potential hostility of the local population was a complicating factor that must often have forced crews to seek alternative landing sites. Another function of small, scattered anchorages might have been as convenient pickup points for agropastoral products to be transported by sea in local and regional trade networks (Rothaus et al. 2003: 40).

Too often, however, the existence of safe, suitable anchorage is taken to be self-evident or based on guesswork that is quite possibly wrong. Often, it seems, the problem of long-term coastal change is simply left unexamined. A common mistake is to assume, implicitly or explicitly, that Bronze Age and modern coastal morphology are essentially the same. Even when some attempt is made to infer changes based on observations of modern coastal landscapes, in the absence of geomorphological analysis the conclusions reached can be misleading or wrong, and are at best limited in their ability to lead to a genuine understanding of ancient coastal environments. The actual changes to Aegean coastlines over time vary widely, but they tend to have localized causes that can only be charted with geoarchaeological techniques. In this chapter, I describe the process of working back to Bronze Age coastlines, and stress the importance of doing so in a systematic way.[1]

Conditions of Discovery

There are few places on the modern coastline to search for Bronze Age anchorages and harbors that can truly be called "obvious." Locations that boast fine harbor basins today, or that preserve harbor works from historical periods of the past, are no sure indicators of high potential for harbors of the Bronze Age. One reason for this is changes in maritime practice – mainly ship technology – over time. It is undoubtedly true that small, shallow anchorages perfectly suitable for Mycenaean shipping could not accommodate the large, heavily laden military and commercial fleets of later Greek and Roman antiquity. Thus, to limit the search to prominent historical and modern harbors would be to miss most of the Mycenaean maritime landscape.

A more important reason is pervasive change over time in the physical topography of the coastline, caused by short- and long-term geomorphological processes. The most prominent of these are sea-level change, sedimentation, marine erosion, and tectonics. Eustatic sea-level change, caused by the cycling of ocean waters into and out of the polar ice caps, has had a profound effect on the world's coastlines since the end of the last Ice Age. Following the last glacial maximum circa 18,000 years ago, at which time eustatic sea level lay

at 90 to 150 meters below present sea level, global warming induced rapid sea-level rise, interrupted only by the cool Younger Dryas event of 10,000 to 11,000 years ago, until circa 6000 BP (van Andel 1989; Wells 2001: 151). In the Mediterranean, maximum sea transgression into coastal areas was reached circa 6000 BP, followed by a stabilization of eustatic sea level. Since that time, global eustatic sea level has slowly risen by no more than five meters or so. Since the LBA, eustatic sea-level rise is only a few meters, a figure that can account neither for observed vertical changes in relative sea level caused by tectonic uplift and subsidence, nor the lateral and vertical changes effected by coastal sedimentation and erosion.

Moreover, the discovery potential for Mycenaean harbors is not the same for all parts of Greece and the Aegean, because regional-scale geomorphological histories may make detection of ancient harbors relatively easier or more difficult. As a result of regional tectonics, some coastlines abound in natural coves and inlets, while others can be characterized as virtually harborless coasts. Faulting of the Greek land mass into mountains and intervening valleys in a general northwest–southeast alignment, followed by inundation of the coasts by the sea, has produced the characteristic pattern on Greece's Aegean (east-facing) shores of promontories separated by deep gulfs, with numerous smaller inlets on a generally rocky coast (Morton 2001: 15–16). The Aegean coast of Asia Minor developed deep inlets reaching tens of kilometers inland at places like Miletos, Ephesus, and Troy. These great estuary and delta systems hosted superb Bronze Age harbors, but have silted in completely in historical times, leaving once-great harbors stranded many kilometers inland.

There are other distinctive patterns. Some coastlines are formed by major faults that separate a mountain ridge from an adjacent collapsed and submerged block; these coasts are steep and linear, with few inlets or offshore islands, and thus little safe anchorage (Morton 2001: 137). Examples of such "harborless" coasts occur in Epirus and Thessaly (the two flanks of the northern Greek mainland), and on the long northeastern coast of Euboea. They tend to be cliffbound and very deep – difficult places to find holding ground for an anchor or to come ashore for provisions. In a few places, perennial rivers have broken through to the coast, forming broad estuaries and deltas. In Epirus north of the Ambracian Gulf, marine embayments or estuaries at the mouths of the Acheron and Kalamas (Thyamis) Rivers provided safe haven and access to fertile hinterlands. If it can be established that the separation of the two blocks forming such coastlines occurred before the Bronze Age, the candidates for harbor locations are few and the search is simplified.

By contrast, the long, west-facing coastline of Elis in the western Peloponnese has witnessed several sequences of accretional barrier and lagoon formation since the end of the Mesolithic period, with the result that most evidence of Bronze Age coastal landforms and archaeological sites is now buried under

meters of sand and wetland deposits. There, investigation of Bronze Age coastal environments requires long-term programs of geological coring, and results remain tentative even after years of study (Kraft et al. 2005).

The lack of knowledge about Aegean Bronze Age coastlines is also partly a symptom of the general historical trajectory of maritime archaeology in the Mediterranean, which in the twentieth century was dominated by studies of ships and shipwrecks, at the expense of harbors and coastal landscapes (Marriner and Morhange 2007: 137–44). The emphasis on ships continues today in both the Old and New Worlds (e.g., Bass 2005a; Blue et al. 2006; Gould 2000). The shipwrecks at Uluburun, Gelidonya, and Point Iria have generated extraordinary information about LBA seafaring and maritime trade, but as restricted spatial and temporal events, they constitute a small part of a much larger picture (Marriner and Morhange 2007: 180). When harbors *were* the object of study, they tended to be the largest and best-known artificial harbors of the Greco-Roman world. Prehistoric and small, natural anchorages and harbors were rarely investigated, nor were there frequent efforts to reconstruct entire "maritime cultural landscapes" formed by networks of landing sites, coastal settlements, and their ties with other communities by land and sea (Westerdahl 1992). In this respect, Mediterranean maritime archaeology is less advanced than in northwestern Europe or the Baltic area (e.g., Chapman and Chapman 2005; Cunliffe 2001; Ilves 2009). Moreover, until recently, maritime archaeology in Greek waters lagged behind other areas in the Mediterranean, such as the Levantine and Turkish Aegean coasts. This can be attributed in part to highly restrictive controls placed on underwater archaeology by the Greek underwater archaeological authority (known as *Enalion*), particularly with respect to foreign teams. As a result, most of the major projects and innovations in underwater technique were developed on the coasts of countries like Israel and Turkey, where permitting was more liberal (Bass 2005c; Raban 1991). In a policy shift that occurred after 2000, Enalion has invited collaborations with foreign teams, and many are now underway alongside an expanded agenda for Enalion's own projects.

It must be pointed out that a long tradition of coastal geomorphology has existed in the Aegean, targeting coastal change over time in both local and regional settings, for example Franchthi Cave (van Andel and Sutton 1988), Asine (Zangger 1994b), Tiryns and the Argive Plain (Niemi and Finke 1988; Zangger 1991, 1994a), Pylos (Kraft et al. 1980), Dimini (Zangger 1991), Troy (Kraft, Kayan et al. 2003; Kraft, Rapp et al. 2003; Rapp and Gifford 1982), Ephesus (Kraft et al. 2000), Miletos (Brückner 2003), and the deltas of the Alpheios (Kraft et al. 2005) and Acheron (Besonen et al. 2003) Rivers. In Greece, this work could generally be accomplished under more easily acquired permits granted by the geological service (IGME). Yet the specific areas in need of development in the Aegean are two: first, there is a lack of systematic programs of research

that identify and investigate local and regional maritime cultural landscapes in a holistic way; and second, programs of coastal reconstruction have often not been closely coordinated with terrestrial surveys and excavations, in terms of research design and planning, shared fieldwork and resources, and joint publication. For example, although all the programs of coastal paleogeography cited above sought to address specific archaeological questions, most were not integrated closely with a particular excavation or survey on land. Meanwhile, excavations and regional archaeological surveys on islands and in coastal areas have rarely extended their focus beyond the shoreline, with the result that the potential of integrative concepts, such as the maritime cultural landscape, which situate coastal regions within interactive networks that unite inland, coast, and sea, has scarcely been tapped (Berg 2010). Some vestiges of the former restrictions remain as mandated by national legislation covering all archaeological activity, including a limited number of available permits for foreign researchers and a clear distinction between terrestrial and underwater permits (these come under separate authorities, and a project can rarely expect to hold both land and underwater permits in a single year). Yet there are many ways to make collaborative research work within the present regulations: much paleocoastal fieldwork can still be accomplished on land under geological (IGME) permits, and it is possible to bring together mixed Greek and foreign nationals to work in a given locality under separate projects and permits. Nevertheless, moving toward a truly holistic coastal archaeology of maritime cultural landscapes will require fully integrated programs of archaeological and geomorphological investigation of sea and land in coastal regions.

Geomorphology of Coastal Zones

Coastlines are among the Earth's most dynamic geomorphological settings. George Rapp and John Kraft (1994: 71–72) list the characteristic and interrelated processes: "local tectonism; eustatic sea level change; climatic change; ocean currents and wave regimes; the nature and frequency of catastrophic events; sources, types, and quantities of sediments available and the resultant aggradation and progradation of deltaic floodplains into erosional and tectonically derived embayments; and the nature and intensity of human activity." Over time, even the most stable coastal environments evolve as sediments accumulate or shorelines erode. Local relative sea level moves up or down in response to changes in the absolute level of the land (tectonics, isostasy[2]), sea (eustasy), or both. Climate and topography control the flow of energy (tides, waves, currents, sediment flux) in a coastal system. The tectonic environment (faults, tectonic events) impacts topography and relative sea level, and sometimes introduces changes to coastal topography that are catastrophic from a human perspective. Finally, human impacts on coastal environments, notably in the form of

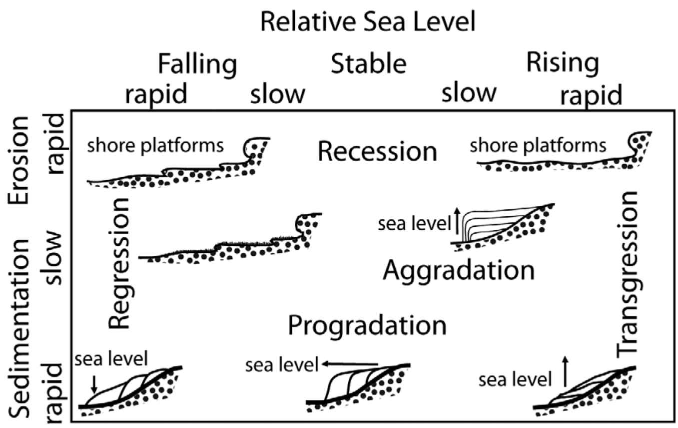
increased sedimentation, have been detected since the Neolithic period in the Mediterranean. The following discussion summarizes briefly the most important processes and materials involved in long-term coastal evolution, following the thorough treatments of the topic by Lisa Wells (2001) and Michael Summerfield (1991: 313–42).

Broadly speaking, a first-order distinction can be made between open coasts and protected coastlines (Wells 2001: 150). Many coastlines cannot be characterized as completely open or completely sheltered, but for a coastal location to have been viable as a harbor, it must have been sheltered to at least a considerable degree from winds and waves. Often, because of shifts in wind direction and intensity during the course of the year, the viability of a harbor may respond to seasonal or even day-to-day conditions.

Open coasts are exposed to the full impact of winds and wind-driven waves, creating high-energy environments and landforms dominated by beaches or rocky shorelines. Coastal erosion is common on open coasts, and sediments tend to be relatively coarse with abundant organic material including woody debris or carbonate particles. By contrast, on protected coastlines, wave energy is attenuated by refraction, creating low-energy environments exemplified by estuaries and tidal marshes in which sedimentation dominates coastal evolution and landform development. Sediments are relatively fine grained and may contain highly organic deposits such as peat. Protected coastlines are ideal locations for sheltered harbors.

Long-Term Coastal Evolution

Coastal evolution can be characterized in terms of the relative motion of the shoreline over time in response to the processes outlined by Rapp and Kraft above, and by the resulting landforms, which can appear and disappear with successive periods of coastal change. Joseph Curray (1964; see also Wells 2001: 154–55) proposed a classification of coasts based on their relative motion over a discrete period of time: (1) *progradational coasts* grow seaward (prograde) as a result of sedimentation; (2) *transgressive coasts* are submerged as a result of relative sea-level rise; (3) *recessive coasts* erode landward (marine erosion); (4) *regressive coasts* emerge as relative sea level falls; and (5) *aggradational coasts* grow vertically (aggrade) when the rates of sea-level rise and sedimentation are roughly equal (Fig. 5.1). The early Holocene record of the Mediterranean, outlined above, provides a good example of rapid and widespread transgression as global sea levels rose. The maximum transgression is often marked by wave-cut notches in a former sea cliff, or other signs of a paleoshoreline stranded far inland from the modern shoreline. After eustatic levels stabilized circa 6000 BP, these transgressive coasts shifted to progradational, recessive, or aggradational, depending on the rate and dynamics of sedimentation and erosion in a



5.1 Classification of coasts by relative motion of the shoreline. After Wells 2001: 154, fig. 6.2. Courtesy of University of Utah Press.

given location. The Aegean coasts of Turkey provide dramatic examples of deep embayments created by the late Pleistocene to early Holocene marine transgression, followed after circa 6000 BP by a gradual but inexorable progradation of tens of kilometers in the major river deltas. The relationship of sea and land created by the interplay of erosion and sedimentation can be altered locally by tectonic movements.

Sediment Supply to Coastal Zones

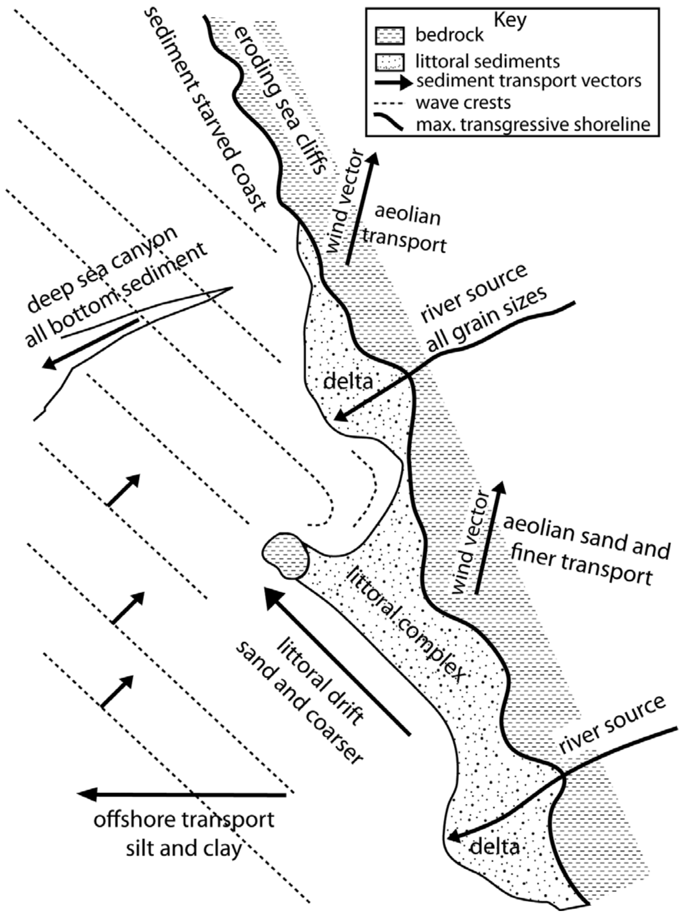
There are three main sources of sediment supply to the coastal zone: (1) the coastal landforms themselves, notably sea cliffs; (2) the land inland from the coast; and (3) material transported from offshore (Summerfield 1991: 324–25). The volume and nature of the sediments are controlled by geology, tectonics, climate, oceanography, and the topography of the sediment source area (Wells 2001: 155). On open coastlines, high wave energy can erode coastal landforms, causing recession and liberating sediment to be transported and reworked. The amount of sediment thus produced depends on wave energy and the degree of consolidation of the cliffs or other landforms suffering erosion.

By far the greatest sediment load, however, is brought to the coast from inland by rivers. On average, mid-latitude coastlines receive more than 90% of their sediment from fluvial sources. Where drainage systems are long and broad (e.g., the Nile, Tigris, Euphrates, Maeander), the material transported to the shore will be predominantly fine grained as coarser clasts are deposited well upstream. By contrast, short, steep drainages carry coarser materials to the coast. In Greece, there are relatively few large, perennial rivers with broad drainage basins (to name two, the Peneios and the Spercheios). Most rivers have a seasonal flow that is heaviest in the winter months as a result of rains that

trigger high-energy, swift-flowing torrents capable of transporting much coarse material. As a result, a typical stony beach will consist of a mix of coarser and finer material.

Free sediment is transported in the interface of coast and inshore waters in several ways (Summerfield 1991: 325; Wells 2001: 155–57). Tides and wave action move sediment continuously and more or less perpendicularly into and away from shore. Wind-driven waves can be significant agents of erosion and sediment transport on open coastlines, but because the Mediterranean is a virtually tideless sea, the effect of tides on coastal processes is minimal. Where offshore winds are strong and persistent, substantial amounts of airborne sand-sized and smaller grains can be deposited onshore (aeolian transport). Yet the dominant movement of sediments along Mediterranean coasts is due to oceanic currents (Fig. 5.2). Generally, the fine clay- to silt-sized sediments escape offshore in suspension and are carried away by oceanic currents. The coarser (sand-sized and greater) material ordinarily remains in the littoral zone, to be entrained in *longshore* currents, which transport material parallel to shore through a process called *longshore drift* (also known as *littoral drift*). The most important contributor to this material is alluvial sediment, but sediments from the erosion of coastal landforms as well as material previously entrained in ocean currents can also be present. The rate and volume of longshore transport along a coastline are controlled by current velocity and wave energy, as well as the angle at which waves strike the coast. The impact of longshore drift on coastal configuration depends on the presence or absence of features of coastal topography and inshore bathymetry that act to impede or facilitate sediment movement. Sediment remains in transit until a sediment sink drains it offshore or an impediment causes deposits to form against it and build up over time. Thus, on linear coasts, longshore drift may proceed with little interruption or effect on coastal configuration. Where coasts have irregular configurations, however, as is so often the case in Greece, longshore sediments become trapped against headlands, offshore islands, delta formations, and other prominent features (Fig. 5.2). These deposits contribute to the development of landforms such as barrier islands, spits, and sandbars, behind which lagoons form. The elongated form of these deposits reflects the prevailing direction and strength of the longshore currents. The long and complex history of longshore-derived landforms of coastal Elis shows these interactions quite clearly (Kraft et al. 2005). Coastal locations downcurrent from significant sediment traps are characteristically starved of sediment, and these features will be absent. Littoral sediments can also be drained offshore by deep-sea canyons.

The overall contribution of sedimentation to coastline configuration can be measured in terms of a sediment budget: if the rate of sediment delivery exceeds the capacity for sediment transport away from the coastal zone, accretion will occur; if not, sediment will remain in transit until it reaches a sediment trap



5.2 Movement of sediments along Mediterranean coasts. After Wells 2001: 156, fig. 6.3. Courtesy of University of Utah Press.

that captures it or conducts it out to sea. It is important to note that even at the local scale, erosion and sedimentation can co-occur. In the region of the lower Acheron River valley of southwestern Epirus, the tectonic structure of the linear Ionian coastline promotes coastal erosion and efficient longshore transport, while within the once-broad embayment at the mouth of the Acheron River, a sharply progradational sequence since the Neolithic period has been documented (Besonen et al. 2003).

Coastal Landforms

The interaction of land, sea, and sky generates a wide array of coastal landforms, which in general terms can be categorized as *destructional* or *constructional* (Summerfield 1991: 325–41). The destructional group is smaller, comprising mainly wave-cut cliffs and shore platforms. The constructional landforms are

many and varied, including beaches, barrier islands and lagoons, estuaries and tidal features, deltas, coastal dunes, and reefs.

Coastal Cliffs and Shore Platforms

Coastal cliffs are steep, often vertical, slopes that rise above the shoreline. Fault-derived cliffs may plunge precipitously into deep water, suffering little erosion since wave energy against them is minimized by reflection of swell waves. In shallower waters, cliffs are susceptible to basal erosion by the action of breaking waves. Particularly on open coasts, wave action undercuts sea cliffs, cutting a notch around mean sea level. Over time, an overhang forms that becomes increasing unstable and eventually collapses into the sea. This material, along with other gravity-entrained colluvium from the slope, is available for reworking and transport in the littoral zone. This erosional process forms recessive shorelines: as the coastal cliffs retreat, horizontal shore platforms are left behind at the basal level where wave cutting occurred. These wave-cut or *intertidal* platforms are common in Greece where high wave energies combine with easily eroded limestone strata. Once formed, they are subject to weathering and abrasion. The rate of cliff erosion varies over time: in particularly stormy years, wave energy and weather can accelerate coastal erosion. If the process continues, however, eventually the cliff will be protected because wave energy is expended crossing the platform.

The sequence of shore platforms and sea cliffs may leave physical traces on land or underwater, particularly where coasts are uplifted or submerged, respectively. The Corinthia in southern Greece preserves examples of both (Hayward 2003: 16–17; Pirazzoli et al. 1994; Wells 2001: 173–75, fig. 6.7). The northern Corinthian plain, bordering the Gulf of Corinth, comprises a stair-stepping sequence of risers and treads that represent Pleistocene coastal cliffs and shore platforms, subsequently uplifted and subjected to faulting and erosion. Beginning in the Neolithic period, these uplifted features were attractive locations for repeated human habitation because they afforded expansive views and defensive possibilities (Tartaron et al. 2006: 496). To the east, the Corinthian port at Kenchreai on the Saronic Gulf is partially submerged as a result of approximately 2.3 meters of tectonic subsidence over the last two millennia. As many as five submerged notches, cut by wave action, dissolution, and bioerosion, have been documented in and around Kenchreai, each representing a paleoshoreline formed during a period of relative sea-level stability (Noller et al. 1997).

Beaches

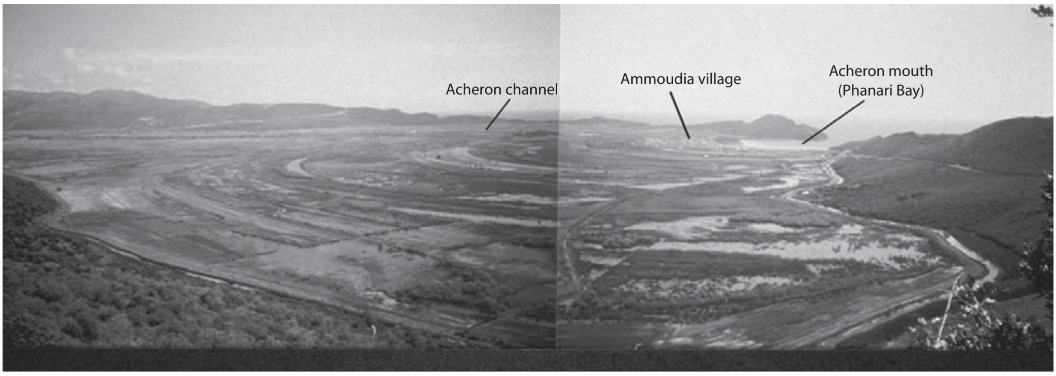
A beach is a shore built of unconsolidated sediment (Hamblin and Christiansen 1998: 398). Beach sediments form at the dynamic interface of land and sea, where

the shoreline is constantly exposed to wave action and littoral currents. Most beaches consist of sand- or pebble-sized clasts (thus, sand or pebble beaches) because wave energy is usually sufficient to remove silt and clay from the littoral zone. Waves and currents sort beach sediments both vertically and laterally, and round and polish the clasts. These well-known processes produce a predictable set of sedimentary structures that allow the identification of fossil beach deposits (Wells 2001: 158, table 6.1).

Beaches are composed of both organic and inorganic material, but in Greece, carbonate pebble beaches are especially common because of the pervasive carbonate geology (limestone and other biogenic carbonates). Beachrock, intertidal sediment indurated by calcite or aragonite cement, forms readily because of the abundance of carbonate in solution in near-shore waters (Wells 2001: 158). Submerged or uplifted beachrock can indicate the approximate lateral positions of former shorelines, particularly in the nearly tideless Mediterranean.

The progradation of sediment seaward is sometimes manifest as sets of sandy, shore-parallel beach ridges and intervening swales. William Tanner (1995) identifies four types, based on their origin. The most common are *swash-built ridges*, which occur where there is a constant source of sandy sediments, but longshore currents are insufficient to remove them. The sediment is instead reworked by modest storm waves (swash) into narrow mounds with low relief along the shoreline. The lower-lying surface between the new ridge and the adjacent landward ridge floods seasonally, filling with sandy near-shore sediment (e.g., backswamp or marshy deposits), thus forming the ridge-swale set.[3] This is a process of gradual accretion, with each ridge representing an old beach and the ridge system marking the advance of the shoreline seaward over time. Formation can be relatively rapid, however: Tanner (1995: 159–60) suggests an average interval of around 50 years for sandy swash-built ridges on ocean coasts. A striking example can be found in Greece at the mouth of the Acheron River in Epirus (Besonen et al. 2003: 216), where concentric accretionary beach ridges and swales have formed in historical times in an embayment well sheltered from longshore currents (Fig. 5.3).

Beach deposits can also grow outward to join with an offshore island by a narrow neck known as a *tombolo*. This typically occurs because the offshore island behaves as a natural breakwater, creating a wave shadow along the coast behind it, where sediment begins to build outward from the shore. Subsequently, longshore drift moves sediments onto and around the tombolo (Hamblin and Christiansen 1998: 399; Fig. 5.4). Tombolos can enhance the natural qualities of an anchorage by creating a double-harbor configuration, and in historical times they were emulated by built causeways. The island of Mochlos off Crete's northern coast is believed to have been connected to the mainland by a tombolo in the Bronze Age (Branigan 1991: 97), and the same may have been true of the southern Cretan harbor at Kommos (Shaw 2006: 55).



5.3 View of the sequence of ridges and swales at the mouth of the Acheron River, Epirus. Courtesy of Nikopolis Project archives.

Estuaries and Tidal Landforms

An estuary is a partially enclosed coastal body of water that communicates with the open sea, but is protected from the action of open ocean waves by its topography or some form of barrier that absorbs and refracts wave energy (e.g., sand bars or barrier islands). Usually the term is applied to inlets into which rivers or streams flow, causing fresh and marine waters to intermingle (Fig. 5.5). These transitional zones between river and ocean environments experience both marine processes (tides, waves, saline water influx) and fluvial processes (freshwater influx, sedimentation), contributing diverse nutrients that make estuaries among the world's most productive natural habitats.

5.4 View of tombolo, Paximadi Cape, Euboea. Courtesy of Tim Bekaert.

5.5 View of an estuary in South Carolina, USA. Courtesy of the National Oceanic and Atmospheric Administration.

Estuaries trap fine-grained sediments, leading to the formation of a variety of landforms such as tidal mudflats, tidal marshes and swamps, and tidal inlets. In the Aegean, where tidal currents are weak, mud and clay are deposited on shallow mudflats in the lower intertidal zone. In the upper (landward) intertidal zone, continued deposition of mud can cause vertical accretion and eventually the formation of a brackish marsh above the normal high tide level. These different landforms exhibit characteristic sedimentary structures and contents (Wells 2001: 158–59, 162). Mudflat sediments typically consist of a mix of silt and clay with a high iron content and in situ molluscan fauna. Tidal marshes are rich in peat, comprising very fine-grained clay and silt with a high organic content. In tectonically stable contexts, marshes build up and out, gradually infilling the estuarial basin.

Estuaries and their associated landforms are highly significant to the study of ancient coastlines. Because of their micro- and macrofossil content, as well as datable organic material, they provide key evidence for coastal evolution. Equally important is the fact that estuaries were a far more prominent feature of coastal landscapes in the Bronze Age than they are today, offering quiet environments ideal for anchorage; these would have been desirable harbor locations throughout the Mediterranean (Raban 1991). Great estuaries at major river mouths are obvious targets for Bronze Age harbors, but because of the tendency of estuaries to fill in over time, smaller estuarial harbors might only be revealed by systematic geomorphological prospection.

Barrier Islands and Lagoons

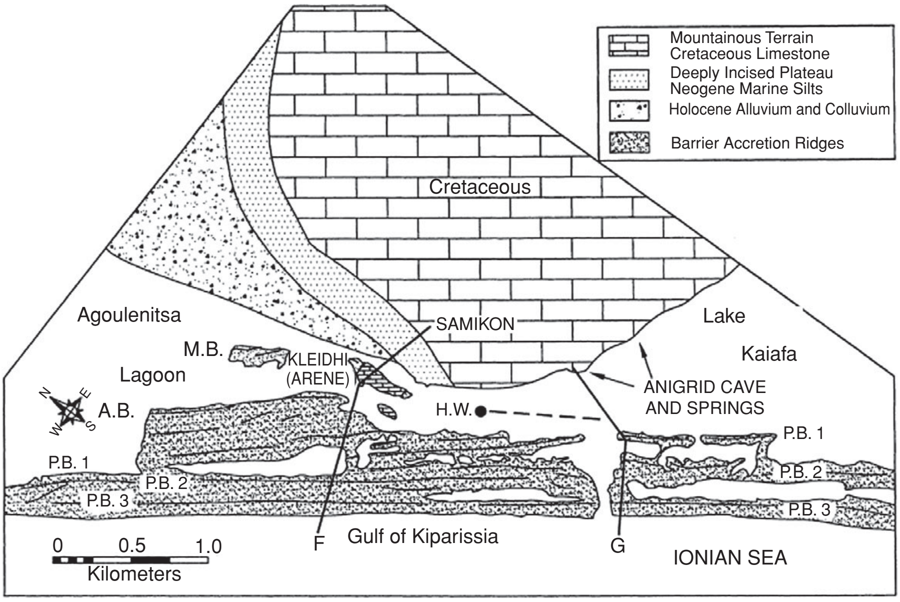
Lagoons are tidal inlets of shallow marine or brackish water that are separated from the sea by a barrier. Mediterranean lagoons are typically sheltered by barrier islands, which are elongated offshore sand ridges extending parallel to the shoreline and separated from it by the lagoon (Summerfield 1991: 330). Barrier islands range from a few meters in width and a few hundred meters in length to long islands a few kilometers in width and hundreds of kilometers in length. Lagoon waters are replenished by tidal inlets that perforate the barrier at irregular and migrating intervals. In response to changes in sediment supply, relative sea level, and climate, barriers may form, retreat landward, or disappear.

Lagoons fill with coarser sediment predominantly supplied by longshore drift. Because lagoons are shallow, they are susceptible to infilling and are strongly influenced by precipitation and evaporation. When evaporation rates are high, salinity in a lagoon can exceed that of the sea, and stranded lagoons can form salt pans or salt lakes. The Akrotiri Salt Lake on the southern tip of Cyprus was probably part of a lagoonal system in the Bronze Age that was later isolated from the sea (Blue 1997: 35–38). Salt deposits were surely exploited in the Bronze Age for subsistence and trade.

The western coast of the Peloponnese is a prominent example of lagoon and barrier formation. On the coast of Elis, coastal landform change has been dominated for the last 8,000 years by longshore redistribution of sediments from the Alpheios and Peneus rivers into an extensive Holocene barrier accretion and lagoonal system (Kraft et al. 2005: 4; Fig. 5.6). In these settings, both sedimentation from fluvial inputs and erosion and littoral transport from high wave energy have shaped Elean and Messenian shorelines into long, sandy beach strands (hence, Homer's "sandy Pylos"). Hans-Jeorg Streif (1964, cited in Kraft et al. 2005: 5) identifies three major alluvial terraces in the Alpheios River system and correlates them with three episodes of coastal barrier accretion at the delta. These are roughly dated to EBA, LBA, and Classical to modern (in several subphases).

Deltas

Deltas form where rivers deposit sediment directly into a standing body of water, such as a lake or the ocean, more rapidly than it can be redistributed by coastal processes. The sediment load deposited by deltas into seas and estuaries creates progradational complexes of river sediments reworked by littoral or estuarine processes. There are two essential components of a river delta: (1) the delta front, comprising the shoreline and the gently sloping, submerged offshore zone; and (2) the delta plain, an extensive lowland area landward of the delta front, made up of active and abandoned distributary channels fanning out



5.6 Example of a lagoon and barrier system on coastal Elis. Kraft et al. 2005: 14, fig. 5. Courtesy of the Trustees of the American School of Classical Studies at Athens.

over the plain (Summerfield 1991: 333–36). The terrain between the channels is occupied by floodplains, levees, tidal flats, marshes, and lakes. All of these features can be recovered in a geological core, and organic material is usually available to establish a chronometric framework for the sequence.

The structure and associated landforms of a delta depend on the interaction of the sediment-carrying stream with ocean currents and waves. Because in Mediterranean embayments, fetch – the distance wind can travel unimpeded by landforms – is limited and tidal effects are minimal, deltas are subject to limited modification by coastal processes (Summerfield 1991: 333). Thus, on a continuum of delta types dominated by tides, waves, and rivers, most Mediterranean deltas are fluvially dominated (Summerfield 1991: 334–35, table 13.4, fig. 13.22). Tectonic and climatic factors also play an important role in delta morphology (Summerfield 1991: table 13.5). If a delta region is tectonically stable, the delta plain will aggrade as it progrades; if subsiding, it will form overlapping sedimentary lobes as it progrades; and if rising, river distributaries will cut down into and rework previously deposited sediments. Precipitation and temperature control the type and amount of the vegetation cover. Once rooted, plants trap sediments and contribute to the formation of peat.

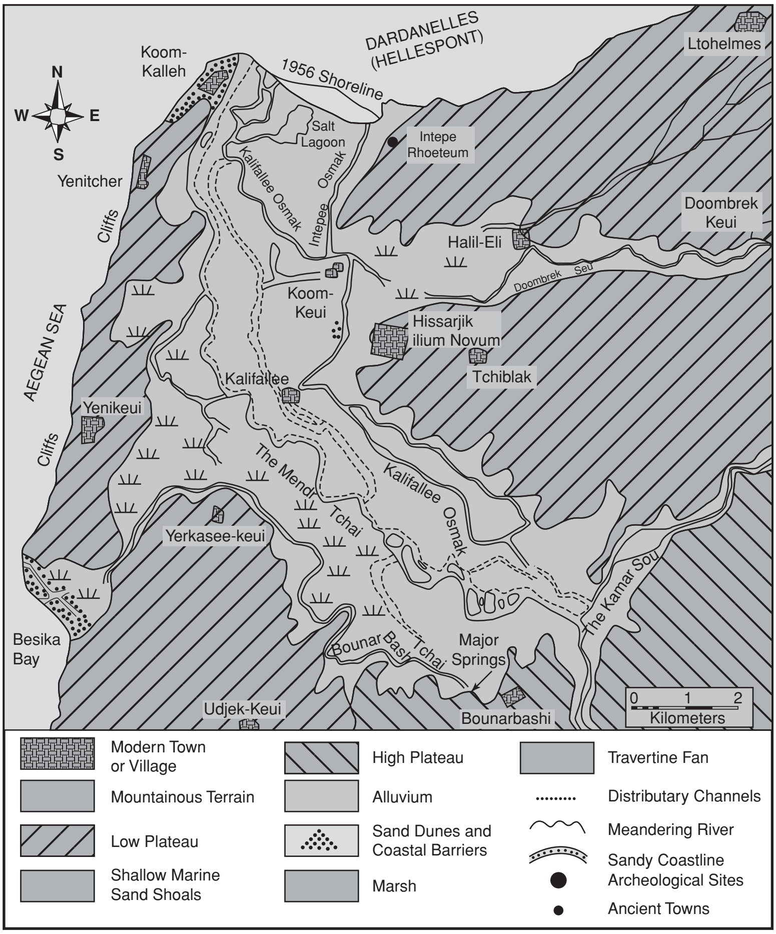
The evolution of Mediterranean river deltas since the mid-Holocene deceleration of marine transgression has been the work of both natural and human agents. As sea-level rise slowed, river sediments began to aggrade (build vertically) and prograde (build laterally seaward) in sheltered and shallow marine

embayments. Wave energy was low, and thus erosion and littoral transport were not prominent mechanisms. Instead, the deltaic material prograded gradually toward the open sea in a landscape of multiple active and abandoned river channels, distributary levees and swamps, brackish to saline lagoons, and isolated ponds or lakes ranging from saline through freshwater (Fig. 5.7). At Troy, it was only as the delta coast approached the Dardanelles that littoral currents and increased wave action deposited sands in nearshore shoals and beaches (Kraft, Rapp et al. 2003: 164), and the same is true of the Maeander River, across the mouth of which a long, arcuate barrier ridge has developed in recent times (Brückner 2003). Kraft and colleagues (Kraft, Kayan et al. 2003: 367, fig. 4) cite the delta of the Spercheios River, emptying into the Gulf of Malia on Greece's eastern coast, as a modern analogue where similar landforms produced by the progradation of the river delta can be observed. There, a complex landscape of meandering levees and backswamps, distributional channels, and pervasive coastal marshes has formed as the delta gradually progrades into the deep, sheltered Gulf of Malia. Because of the absence of high wave energy and littoral drift at the current delta shoreline, no coastal barriers have formed.

Coastal Sand Dunes

Coastal sand dunes can form in a range of settings, including deltas, coastal plains, and embayments. They are aeolian landforms that develop where certain conditions exist: coastlines where waves and currents interact with abundant loose, sand-sized sediments available for transport; persistent onshore or alongshore winds blowing for at least part of the year at 16 kilometers per hour or more; and flat or low-relief terrain immediately inland of the coastline (Bauer and Davidson-Arnott 2002; Martínez et al. 2004; Pye 1983). Dune formation occurs when winds blow dry sand particles landward from the beach; the main sources of the sand are exposed offshore sandbars and river-mouth and other backshore sediments. Objects inland from the coast, such as plants, logs, or human constructions, interrupt the wind flow, causing sand to be deposited in drifts around them. These drifts act as barriers to sand movement, and grow over time to landforms ranging from small hillocks to vast dune systems tens of meters in elevation.

Sediment supply is the key limiting factor to dune formation. Fluvial systems are noteworthy for the large amount of sediment that they can contribute to dune formation: the Nile River has supplied sufficient sands to result in the formation of vast belts of dune ridges (El Banna and Frihy 2009). In Greece, coastal dunes are common, but because of the prevalence of rocky (as opposed to sandy) shorelines and mountainous coastal topography, long, continuous costal dune systems such as are found on French or Dutch coastlines are rare. Instead, coastal



5.7 Formation of the Scamander plain, Troy. Kraft, Kayan et al. 2003: 365, fig. 2. Courtesy of Springer Science+Business Media.

dunes tend to occur in isolated embayments between promontories and cliffs, or as more extensive but discontinuous coastal dune systems, for example in the western Peloponnese or on Euboea's eastern coast (Heslenfeld et al. 2004: 338; Spanou et al. 2006: 235–37, fig. 1). They tend to exist where barrier islands or wave-dominated depositional landforms occur, often as integral elements of barrier and lagoon systems (Kraft et al. 2005).

Coastal dunes perform several functions beneficial to the stability of coastlines and potentially to humans as well. They shield low-lying coastlines from violent storm winds and waves, and inhibit coastal erosion. They protect against saltwater intrusion into wetlands and dry lands behind them, and they support a diverse flora and fauna (Spanou et al. 2006; Sýkora et al. 2003). Thus, they form an integral part of coastal ecology and the resources to be found there.

The Anthropogenic Contribution

The human role in coastline formation has been conspicuous in two processes: the acceleration of sedimentation to prograding river deltas, and the creation of artificial harbors. It has long been noted that the shift to settlement in sedentary agropastoral communities in the Mediterranean coincided with mid-Holocene delta formation and shoreline progradation in the estuaries that had resulted from the late Pleistocene–early Holocene marine transgression. Human agency in soil loss – caused by stripping vegetation cover through forest clearing, agriculture, and grazing – has been implicated in increased sediment load to streams and the resulting expansion of deltas and related coastal landforms. But it is not easy to demonstrate a primary human role in this process, particularly for periods as remote as the Neolithic and Bronze Ages. There are three related problems: contemporaneity, causality, and degree of impact (Halstead 2000). The palynological, geoarchaeological, and archaeological data used to assess human impact on sediment load to coastal areas can often be dated only approximately, with the result that the contemporaneity of the impacts seen in these data sets is highly uncertain. Even when the chronological correlation is fairly secure, human causality, as opposed to a variety of climatic and other environmental changes, can be difficult to establish. Finally, the magnitude of the human impact, given the level of population and the specific activities in which communities were engaged, must be evaluated. Can it be demonstrated that Bronze Age population levels in and around coastal drainage systems were sufficiently large and their subsistence practices sufficiently destructive to account for significantly accelerated delta formation and coastline progradation?

In Greece, the most detailed documentation of putative human agency in landscape destabilization resulting in erosion and catastrophic soil loss comes from the southern Argolid. The regional surveys of the Argolid Exploration Project in the 1970s to the 1990s amassed a large body of geological and archaeological data that seemed to indicate human agency in certain episodes of massive Holocene soil erosion (Runnels 1995, 2000; van Andel et al. 1986, 1990; Zangger 1994a). One of these (the Pikrodafni alluvium) was dated broadly by pottery sherds to the end of EH II, and was concentrated in valleys where FN–EH II settlement was extensive (van Andel et al. 1986: 113). The Pikrodafni alluvium is dominated by debris flows: " . . . chaotic beds of ill-sorted, largely angular boulders, cobbles, and pebbles, surrounded and supported by a matrix of finer material" (van Andel et al. 1986: 111), likely the result of sheet erosion of slopes made vulnerable to soil loss when vegetation cover was devastated by drought, fire, or clearing. Although a change of climate to drier conditions that reduce vegetation may instigate sheet erosion and result in debris flows, the investigators attributed the Pikrodafni alluvium to careless slope clearance and

the " . . . eventual failure of EH agriculture to contain the loss of soil" (van Andel et al. 1986: 117). This conclusion has been questioned on the grounds of chronological and causal ambiguity as outlined above (e.g., Bintliff 1992; Butzer 2005; Endfield 1997; Moody 1997, 2000; Whitelaw 2000). This debate highlights the problems and underscores the need to assess each event on its own merits before wider inferences about regional land–human relationships can be made.

In general, it is unlikely that the effect of human subsistence activities was such that large natural harbors were strongly affected in the Bronze Age, and particularly it is doubtful that humans made a greater contribution to sedimentation than the combination of climatic oscillations and natural sediment transport after the mid-Holocene stabilization of eustatic sea level. This conclusion is supported by much geomorphological research that shows that rapid infilling of major natural embayments and estuaries in the eastern Mediterranean has been a phenomenon of much more recent times (Brückner 2003: 122–25; Kraft, Kayan et al. 2003; Raban 1991). On the other hand, small natural inlets and harbors based on barrier and lagoon systems must always have been more susceptible to both anthropogenically and naturally induced sedimentation (Kraft et al. 2005), migrating and going in and out of practical use with much greater frequency.

The creation of artificial harbors in the Bronze Age Aegean is unlikely, but cannot be ruled out entirely. This kind of harbor is an artificial estuary or lagoon, where breakwaters have been constructed to reduce wave energy, creating a quiet and sheltered environment in which vessels may operate. At the same time, by minimizing the normal forces of waves and littoral currents, artificial harbors promote the net accumulation of sediment. A universal feature of artificial harbors is that they must be maintained by dredging or by some means of flushing sediment from the harbor basin. All of the processes that occur in natural estuaries also occur in artificial harbors, but they may be accelerated due to intensive human presence. Because the maintenance of harbors responds to the ebb and flow of political and economic conditions, the eventual infilling and abandonment of artificial harbors are all but inevitable (Wells 2001: 171).

Artificial harbors leave distinctive signatures in the geoarchaeological record, which allow them to be distinguished from natural harbors. Nick Marriner and Christophe Morhange (2007: 175–77) have identified a fairly consistent geomorphological sequence repeated throughout the eastern Mediterranean, which they term the "Ancient Harbour Parasequence" (AHP). The AHP comprises the depositional history of the harbor basin, from the natural pre-harbor state to postabandonment, with the following surfaces (boundaries) and deposits (facies):

(1) The Maximum Flooding Surface (MFS) marks the maximum marine transgression circa 6000 BP. It forms the lower boundary of the sediment

archive, and laterally the farthest landward position of the coast. The deposit is characterized by coarse sand and pebbles.

(2) After 6000 BP, beach sands began to aggrade naturally, overlaying the MFS with little or no human contribution. Net sediment supply increased as the coastline prograded and the basin began to fill.

(3) The Harbour Foundation Surface (HFS) marks the incipient human modification of the basin, in the form of built harborworks, to create a sheltered harbor basin. A sharp transition from coarse beach sands to fine-grained silts and clays characterizes the sedimentology of the harbor basin. In most of the Mediterranean, this surface postdates the Bronze Age. Human exploitation of natural low-energy basins in the Bronze Age is rarely measurable on the basis of granulometry, but can sometimes be detected in subtle patterns of molluscan micro- and macrofossil assemblages (Marriner and Morhange 2007: 176).

(4) The Ancient Harbour Facies (AHF) refers to the stratigraphic sequence of deposits during active use of an artificial harbor. Enhanced harbor engineering through time is evident in increasingly fine deposits (silts and plastic clays) through the Roman period, and remnants of harbor architecture (moles, breakwaters, quays, etc.), artifacts, and other anthropogenic debris are often present. The AHF may generate a diagnostic assemblage of macro- and microfauna, as well as a strong geochemical signature from human pollutants.

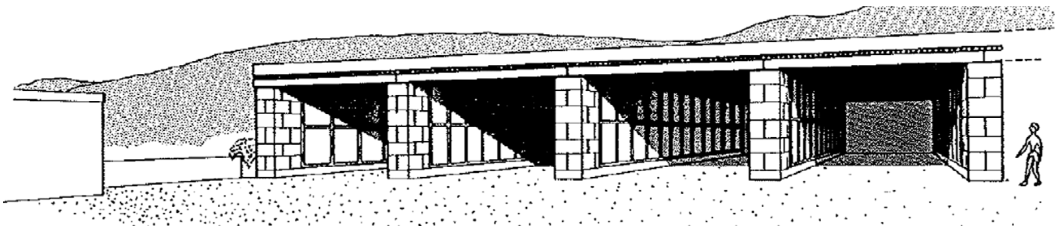
(5) The Harbour Abandonment Surface (HAS) records the initial (semi-) abandonment of the harbor basin, often after the Late Roman period. It corresponds to the deterioration or abandonment of maintenance of harbor infrastructure, and is marked by a transition from fine-grained harbor silts and clays to coarse sands and gravels.

(6) The Harbour Abandonment Facies (HAF) registers a return to "natural" conditions after the harborworks have deteriorated to the point that the basin is exposed to higher-energy wave action and the formation of coarse-grained sand and gravel beaches.

The Ancient Harbour Parasequence framework has been applied by this investigative group to ancient harbors including Beirut (Marriner et al. 2008), Sidon and Tyre (Marriner and Morhange 2006), and Marseille (Morhange et al. 2003), and they have also fitted the geostratigraphy of other harbors, such as Caesarea Maritima (Reinhardt and Raban 1999), into this scheme (Marriner and Morhange 2007: 172–74, fig. 29).

Natural versus Artificial Harbors in the Mycenaean World

As observed above, it is widely assumed that neither artificial harbor basins nor durable built harbor infrastructure existed in the Aegean Bronze Age. Centuries later, Homer and Hesiod were barely aware of artificial harbors



5.8 Reconstruction of ship sheds at Kommos. Shaw 1990: 425, fig. 9, drawing by Giuliana Bianco. Courtesy of the Trustees of the American School of Classical Studies at Athens.

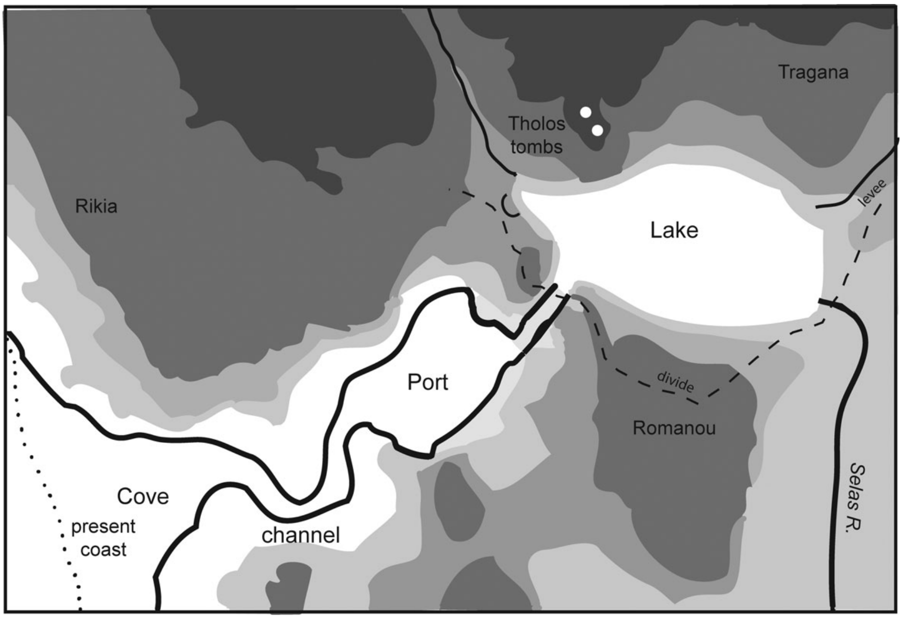
(Morton 2001: 106), and the image of Odysseus' crews dragging their ships onto sandy beaches has been held up as representing standard practice in the Bronze Age. But is this really the case? Blind acceptance of the notion that all Bronze Age harbors were natural, and that ships were simply pulled up onto sandy beaches in the Homeric style (e.g., *Iliad* 1.485–86), has been justly criticized by Avner Raban (1991: 136) on the grounds that it has prevented investigators from looking for artificial harbor works or from accepting evidence for them. Nevertheless, to date there remains little evidence for built harbor infrastructure in the Mycenaean world. The Minoans, perhaps because of their earlier contact with Egyptian and Near Eastern seafaring societies, seem to have been more advanced in this respect. At a small number of Cretan coastal sites, large buildings divided into long, narrow galleries have been interpreted as ship sheds, used for storage of ships and nautical equipment during the winter months.[4] The clearest case is the excavated Building P at Kommos (J. Shaw 1990; M. Shaw 1985; Shaw and Shaw 1999; Fig. 5.8); at more than 37 meters long and 5.6 meters wide, the galleries of Building P could accommodate the largest of the ships depicted in the Akrotiri Flotilla Fresco (see Table 3.1). Other candidates for ship sheds include the "Shore Building" or "Shore House" at Gournia (Fotou 1993; Shaw and Shaw 1990: 852, n. 16; Watrous 2010), as well as unexcavated foundations and cuttings at Malia and Nirou Chani (Marinatos 1926: 146; Raban 1991: 139–40; Shaw 1990: 425–28). Elsewhere, cuttings and ruins of built features have been proposed as channels, moles, and tombolos associated with Minoan harbors (Chryssoulaki 2005; Hadjidaki 2004: 54–56). These features cannot at present be dated directly; typically, they are considered to be Minoan based on close spatial, but not stratigraphic, association with remains of Minoan buildings or artifacts. Nothing comparable has been identified on the Greek mainland.

Even the well-dated Building P is beset by interpretive issues that are crucial for the present discussion. Building P was constructed over the ruins of LM I Building J/T during pottery phase LM IIIA2, corresponding to the later fourteenth century BC. This was a time of new beginnings in the Mesara region; at nearby Ayia Triada, a megaron-style building was constructed, similar to contemporary Mycenaean megara on the mainland. A spirited debate continues

on whether the Mycenaeans exercised political control over large parts of Crete during this time. If so, Building P could be a Mycenaean construction, as it has sometimes been called (Haggis 2003; Yasur-Landau 2010: 50). The excavators do not share this view, however (Shaw and Shaw 1997). They find no close parallel for Building P on the Mycenaean mainland, and they continue to believe that the Mycenaeans exercised neither direct political control nor extensive cultural influence over the Mesara in the Late Bronze Age. Instead, they point to iconographic evidence for the non-Mycenaean origin of the Cretan ship shed (J. Shaw 1990: 429–32; M. Shaw 1985). At Akrotiri, a portion of the Flotilla Fresco on the north wall of Room 5 depicts soldiers marching to the right of a large building partitioned into narrow, open galleries facing the shore, very similar in form to Building P. The fresco at Ayia Irini on Kea depicting a seaside scene may also preserve the corner of such a building (Shaw 1990: 430–31).[5] The idea of an earlier Minoan tradition finds support at Gournia: on the putative ship shed there, Vance Watrous (2010: 13) comments, "Similar in material, masonry, and monumental scale to the palace at Gournia, the ship-shed galleries seem to have been built at roughly the same time as the palace, probably in MM IIIA." Thus, the Cretan ship sheds bring us no closer to definitive proof of Mycenaean built harbor infrastructure.

If the Mycenaeans did not erect built structures to enhance coastal topography, in one case at least they seem to have created an artificial harbor basin at a remove from the coastline. At Romanou near Pylos, according to Eberhard Zangger and associates, the Mycenaeans created an artificial harbor basin by means of a sophisticated hydraulic engineering project (Zangger et al. 1997: 619–23; Fig. 5.9). A natural depression comprising soft fossil dunes some 500 meters from the Bronze Age shoreline was widened and deepened to serve as the harbor basin. A channel approximately 40 to 50 meters wide was dug to connect this basin to a small natural cove at the coast that had probably been the original anchorage. To prevent longshore sediments from silting up the harbor basin, the perennial Selas River was diverted upstream to provide a steady flow of clean water to flush the basin. The Selas was first diverted into a lake, and from there an outlet controlled the outflow of clean overspill water, which was conducted by an artificial canal to the harbor basin. The diversion of the Selas River has been dated to the LBA by establishing the radiocarbon chronology of a sharp drop in terrestrial sediments in cores from the Osmanaga Lagoon, the natural outlet for the river prior to the diversion (Zangger et al. 1997: 622). The result was a sheltered and readily defensible inner harbor.

The components of this harbor virtually disappeared from the landscape once the authority that maintained it was gone; it was only recognized through a careful and expert geomorphological analysis, and to date remains the only known Mycenaean artificial harbor. Nevertheless, this approach to harbor construction is entirely in keeping with the ambitious hydraulic engineering projects



5.9 Hypothetical reconstruction of an artificial harbor at Pylos. Drawing by Felice Ford after Zangger et al. 1997: 619, fig. 46.

at which the Mycenaeans excelled, the most prominent being the drainage and water management of the Kopais Basin in Boeotia (Knauss 2001), and the Kofini Dam near Tiryns (Zangger 1994a). The work of geomorphologists reminds us that Bronze Age coastal features, whether natural or artificial, are difficult to detect, yet it is possible to read them from the modern landscape if one is attuned to the traces they leave behind and adept in the techniques for recovering them. Although it is unlikely that many harbors as elaborate as the one at Romanou existed in Mycenaean times, this discovery does provide an example of the kind of harbor engineering of which the Mycenaeans were capable, and offers impetus to continued search for other engineered harbors.

Apart from natural harbors that were used during the Bronze Age, a variety of coastal wetlands could be exploited for diverse uses and resources. Deltas, estuaries, and lagoons are merely part of a broader series of coastal landscapes characterized by high biomass and biodiversity, which may also include lakes, bogs, river floodplains, spring-fed wetlands, and seasonally inundated dolines and poljes (Van de Noort and O'Sullivan 2006: 36–64). From such coastal settings in the Mediterranean, resources were readily available such as reeds and rushes for architectural construction; clay for pottery, mudbrick, and other architectural applications; and fish, waterfowl, amphibians, and mollusks.[6] Wetlands are underappreciated as a resource for Bronze Age communities partly because in the modern world their settings are peripheral and they are rapidly disappearing through reclamation and other forms of human interference.

Geoarchaeological Methods for Reconstructing Coastal Landscapes

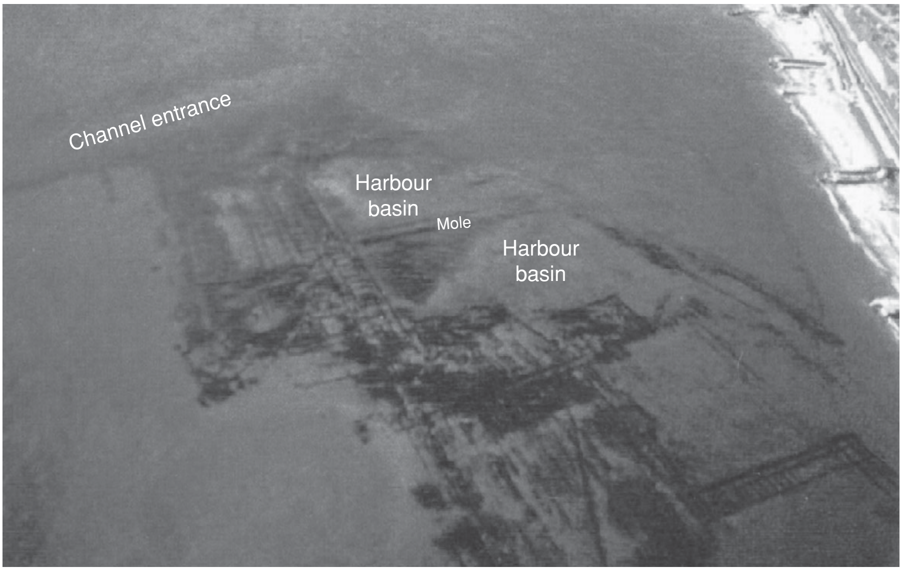
The investigation of ancient coastal landscapes by geoarchaeological means is a well-established tradition with a rich literature, but one that continues to evolve with technological advances and new perspectives influenced in part by recent trends in landscape archaeology, giving rise to a "theoretically informed landscape approach" (Breen and Lane 2003: 469–70; Marriner and Morhange 2007: 180). The methodology of coastal geoarchaeology involves extensive work in both the field and laboratory, and a wide range of materials as proxies for past conditions and processes. The basic principles and techniques are widely published and demonstrated by case studies (e.g., Marriner and Morhange 2007; Rapp and Hill 1998: 75–81; Summerfield 1991: 313–42, 433–55; Wells 2001). To be truly effective, these techniques must be performed in combination, and to realize their potential to illuminate the human past, they must be integrated with archaeological investigation.

The purpose of this section is to summarize the elements of a robust geoarchaeological investigation of a coastal landscape, following the framework outlined by Marriner and Morhange (2007; see also Brückner 2003: 125–26; Goiran and Morhange 2003) that broadly divides the work between field and laboratory techniques.

Field Techniques

Geomorphological survey involves the initial mapping of coastal landforms, typically starting from maps (geological, topographic, soils), images (satellite, aerial photographs), and archaeological information (chronological, distributional) on sites and features in the coastal zone. These documents may reveal a wealth of information, and form a baseline for the research design. High-resolution satellite images and low-altitude aerial photographs often yield visual evidence for coastal landforms, such as barrier and lagoon systems, or evidence for ancient harbors, such as uplifted harbor basins or submerged harbor installations (Fig. 5.10).

Subsequent ground truthing, both on land and under water, allows natural and anthropogenic features to be studied firsthand in order to form provisional hypotheses about the morphology, genesis and developmental sequences, and chronology of coastal landforms. In many cases, landforms may be visible, for example, dune ridges, infilled lagoons, estuaries, river and stream features, beach ridges, and fossil sea cliffs, but they must be constrained chronologically and present morphologies should not be extrapolated to the past without detailed analysis. Indications of sea-level change may be apparent in submerged buildings, stranded harbor basins, wave-cut notches on fossil sea cliffs, erosion



5.10 Aerial photograph of submerged harbor remains near Naples. Reprinted from Marriner and Morhange 2007: 151, fig. 13, with permission of Elsevier.

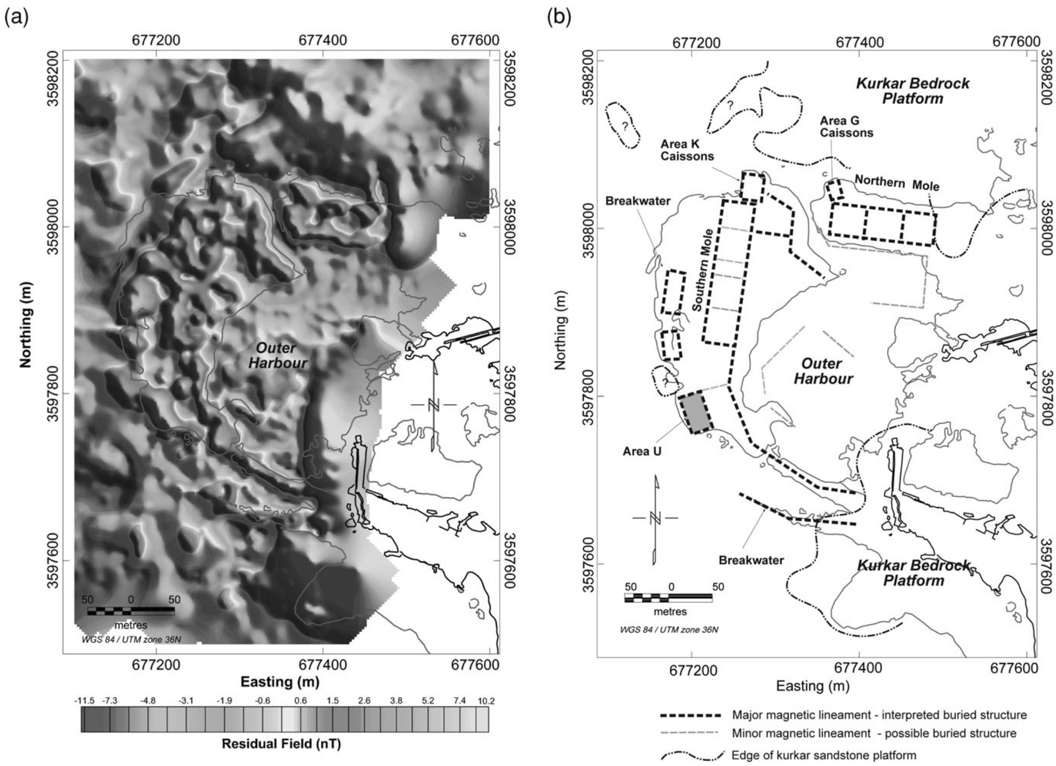
benches (platforms), and other terrestrial and underwater features. Road cuts, irrigation ditches, foundation trenches, and eroded coastal cliffs are common targets of opportunity providing windows onto past depositional and erosional sequences. There are two essential principles that must guide observations about sea-level change, however. First, the critical consideration is *relative* sea level; that is, the relationship between land and sea at any location is affected by erosional, depositional, and tectonic processes, and not merely by the absolute changes suggested by global or regional eustatic sea-level curves. Consequently, the second principle is that each coastal location has its own relative sea-level curve, determined by local tectonic controls as well as distinct erosional and depositional characteristics. Rapp and Kraft (1994: 73) emphasize that composite regional sea-level curves, or those borrowed from "nearby" localities, usually lead to errors in interpretation.

Observations of visible coastal landforms and archaeological features often form the basis for speculation regarding the layout and date of ancient harbors. This tradition is particularly strong with respect to purported Minoan harbors on Crete (Chryssoulaki 2005; Hadjidaki 2004; Marinatos 1926; Raban 1991; Shaw 1990). Typically, the evidence might include artifact concentrations, foundations of Minoan-style walls extending into the sea, anchors found in the nearby sea bed, or cuttings in bedrock that cannot be dated. The arguments for the existence of these harbors often cite the prominence of Minoan seafaring in the Bronze Age (Chryssoulaki 2005; Hadjidaki 2004), an important consideration but not a directly relevant form of evidence. Thus, although reasonable hypotheses

may be derived from archaeological observations and general historical arguments, little can be said with real conviction, and little detailed information can be obtained, in the absence of a full geoarchaeological assessment. Marriner and Morhange (2007: 162) cite the cautionary tale of the harbor at Kition-Bamboula on Cyprus, which two researchers depicted as a cothon based on modern engravings and field observations, before a geoarchaeological investigation revealed this to be erroneous (Morhange et al. 2000).

Geophysical survey employs nondestructive techniques to detect remotely subsurface features on land and under water. In terrestrial archaeological contexts, extensive use has been made of ground-penetrating radar, magnetometry, electromagnetics, and resistivity (Kvamme 2003; Sarris and Jones 2000). Each instrument and technique has its optimal use conditions and detection characteristics. Because harbors and other coastal features are often buried in sediment, geophysical surveys can frequently reveal the outlines of buried features, provided that their properties (magnetism, conductivity, density, etc.) contrast sufficiently with the surrounding matrix, and that they are located vertically within the detection limits of the geophysical instrument. An excellent example is the buried harbor and urban area of Portus, where Simon Keay and colleagues integrated the results of magnetometry, resistance survey, ground-penetrating radar, and electrical resistivity tomography to reveal much of the plan of Rome's principal imperial port (Keay et al. 2009). These results were confirmed and expanded with programs of coring and excavation.

Comparable techniques can be used to detect features on the sea floor and buried in marine sediments beneath it, typically by towing geophysical equipment on a rig attached to a small boat. Side-scan sonar and sub-bottom profiler surveys are used to create bathymetric maps that measure depths of sediment and bedrock, giving indications of the shape and orientation of ancient harbor basins over time (Lafferty et al. 2006; Papatheodorou et al. 2001). Marine magnetic surveys are well established and have often yielded spectacular results where underwater features with strong magnetic signals are present. A magnetic survey off the coast of Caesarea Maritima in Israel – Herod's Roman harbor – has clarified a number of questions concerning its construction and use. The magnetic data revealed the hydraulic concrete foundations for the ruined harbor moles by detecting the volcanic ash (pozzolana) in the concrete as a strong magnetic anomaly (Boyce et al. 2004; Fig. 5.11). These results allowed new interpretations of the shape and construction of the now-submerged outer harbor, defined by the moles and additional breakwater structures. Detected in the same survey were numerous low-relief mounds with elevated magnetic signals, on the sea bed beyond the outer harbor. These features, subsequently investigated by jet probing and excavation, turned out to be ships' ballast piles, identified by a mixture of igneous and metamorphic boulders and fired pottery exhibiting strong magnetic properties (Boyce et al. 2009). It was even possible, through



5.11 Plan of submerged remains at Caesarea Maritima. From Boyce et al. 2004: 132, fig. 8. Reproduced with permission of Blackwell Publishing Ltd.

careful mapping and examination, to hypothesize the formation process of the ballast piles by ships anchored around a designated anchorage point (Boyce et al. 2009: 1524). Ballast piles associated with Bronze Age pottery have recently been discovered off the Saronic Gulf coast at Kalamianos (Tartaron et al. 2011; see Chapter 7).

Geophysical techniques are nondestructive and non-intrusive, yet they can often supply rapid and reliable information about the location, depth, and nature of buried or submerged features without excavation. They may play the key role of guiding subsequent coring and excavation strategies, and more generally helping to form hypotheses and research questions. A geophysical project will more than pay for itself if it saves the investigator from a misguided research design. There are also disadvantages to geophysical surveys. There is no chronological control on the stratigraphy and archaeological features they detect, and the interpretation of anomalies often involves a high degree of subjectivity if their forms and signals are not transparently characteristic of known features. Ground truthing, in the form of excavation, coring, or other means of direct examination, is usually required to verify the identity of potential archaeological features. The entire enterprise of archaeological geophysics relies on a

high level of expertise and expensive equipment that may not be easily available or affordable. Nevertheless, geophysical surveys are indispensable for the investigation of buried harbors and submarine features.

Coastal stratigraphy is the central concept of the geoarchaeological method, which entails direct observation of the geological record to locate, characterize, and reconstruct physical evidence of natural and anthropogenic processes that contribute to the long-term evolution of coastal environments. As we have seen, observations of the modern surface can be misleading or ambiguous in their relationship to the past, but all major processes that generate change (cited above) leave a record in local sediments that can be decoded by careful analysis. Ideally, one would excavate a number of sections of the vertical and horizontal dimensions of coastal and underwater sediments, but this approach is rarely feasible in terms of resources (including time and money) and permissions. Thus, geological core drilling[7] is the method of choice to obtain sediment samples for analysis. The decision about where to sample and how many cores to take is a critical aspect of the research design. Although it is obvious that enhancing the resolution of the study, that is, by increasing the number of cores and decreasing the spatial interval at which they are taken, should lead to higher confidence in the results, given the usual constraints a well-rationalized sampling design is of the utmost importance. Moreover, no coring program, no matter how large or well designed, will provide all the answers hoped for, but will generate new questions that can only be addressed with further research. A perfect illustration is the decades of coring work dedicated to reconstructing the marine embayment and coastal paleogeographies of ancient Troy (Kraft, Kayan et al. 2003; Kayan et al. 2003). Hundreds of cores have now been taken and analyzed from the plain around Hisarlik, yet although the general outlines of the evolution of this coastal landscape are reasonably well understood, the details of interpretation continue to be debated and new questions remain to be addressed.

Many macroscopic attributes of the core sample are described in the field, using one of a number of recording systems (e.g., Folk 1980). In the lower Acheron River valley of southern Epirus, Mark Besonen and colleagues recorded lithology, grain-size distribution, color when wet using the Munsell soil color chart, sediment consistency, plant and animal macrofossils, pedogenic characteristics (structure, sesquisoxide/reduction mottling, and calcium carbonate filaments or nodules), and chance finds such as pottery fragments (Besonen et al. 2003: 209). The depth of the core varies with the equipment used and the nature of subsurface layers encountered. Hand-augering is the conventional technique, because the instrument is portable and widely owned by earth science departments and private geological firms. With hand-operated equipment, it is not uncommon to reach impenetrable stony layers well before the maximum length of the auger. More elaborate power corers generally do not have this limitation (Kayan et al. 2003: 382–84), but their use is far more expensive and they may not

be readily available in country. Once the attributes of the core are described, all or part of each sediment column is packed in aluminum foil or some other protective material for transport to the laboratory.

Laboratory Techniques

The core that reaches the laboratory preserves a stratified, and thus diachronic, record of the sedimentary sequence at a specific location. It is a storehouse of information, but decisions must be made about the tests that will be performed and the materials that will be tested, as well as the resolution at which the examinations are to be made. The tighter the sampling interval, the higher the resolution of the data and the better the reconstruction of coastal stratigraphy and coastal history (including chronology); Marriner and Morhange (2007: 165) recommend five centimeters or less. Time, money, and expertise for analysis are costs that should be resolved before coring begins.

After initial description of sedimentary structures, the cores are separated into subsamples to be used for analyses of different proxy materials. These analyses broadly involve sedimentology, biostratigraphy, and geochemistry.

Sedimentological analysis allows the investigator to characterize the sedimentary structures of a core sample and to identify the environmental *facies* that are represented in the stratified deposit.

The structural characteristics of the sediment provide important clues to the depositional environment and the source of the material that formed the deposit. Typically, subsamples are analyzed for color, grain size, microfossils, organic matter, and calcium carbonate content; organic material is extracted for radiocarbon (usually AMS) dating and sherds or other cultural material are noted (Jing and Rapp 2003: 159, fn. 4).

Granulometry – the analysis of grain size, shape, sphericity, roundness, and sorting of clastic particles in a sediment – can indicate the mechanisms of transport and deposition and distinguish between high- and low-energy formational environments in a coastal area. Sediment texture refers in part to the range of particle sizes present; these are determined by a process of wet and dry sieving to separate the gravel-, sand-, silt-, and clay-sized fractions (Rapp and Hill 1998: 22–23, figs. 2.2, 2.3). These fractions are then weighed and their relative proportions are plotted graphically and statistically. The resulting ratios can indicate different kinds of coastal environments; for example, predominance of gravel and sand may indicate a fossil beach; predominant sand may indicate littoral deposits such as sandbars, barrier reefs, and islands; and predominant silts and clays may indicate an artificial harbor basin. The association between grain size distribution and paleolandform is not always straightforward, however. Rapp and Hill (1998: 38–39) identify five factors influencing grain size distribution: (1) the type of source rock and the original size of grains; (2) the type of

transporting medium; (3) abrasion and solution during transportation; (4) sorting of size fractions before deposition; and (5) the depositional environment. Thus, the sources of sediment (e.g., fluvial, aeolian, longshore), the distance of transport, and the reworking of sediments in the coastal environment are some of the variables in working back to coastal paleoenvironments. Artifacts that may be present as clasts in the sand- and gravel-sized fractions are of great interest when recovered from cores.

Cores are also sampled for biogenic material, which can provide conclusive evidence for the depositional environments in which particular species lived. *Biostratigraphy* entails the identification of fossil organisms and the study of their temporal and spatial distribution in order to record the changing abundance and species composition, and thereby to reconstruct the depositional environments (biofacies) that these organisms characterize. The main fossil types are marine mollusks, ostracods, and foraminifera, each being both abundant in coastal waters and specific in its environmental tolerances to depth, salinity, and temperature.[8] For this reason, they are excellent indicators of depositional environment and accordingly are used widely in paleoenvironmental reconstruction of coastal regions.

There are different advantages and disadvantages to these fossil types. Marine mollusks tend to be abundant, with known environmental tolerances by species. In situ shells are useful for radiocarbon dating. Mollusk shells are often the primary component of coastal middens that may be detected during archaeological or geomorphological survey. Ostracods are microcrustaceans that leave a calcite bivalve carapace, the morphological characteristics of which can provide taxonomic and phylogenetic information (Marriner and Morhange 2007: 170). They tend to be ubiquitous in both fresh and marine waters, their carapaces preserve well, and because of their small size a great number can often be extracted from a core subsample. They are excellent indicators of paleoenvironment because their composition, population density, and population diversity vary as a function of water temperature, water salinity, water depth, and anthropogenic impacts (Marriner and Morhange 2007: 170). As a result, ostracod species are strongly correlated with very specific depositional environments.

Foraminifera are single-celled organisms with tests divided into chambers that accumulate during growth. They are among the most ubiquitous shelled organisms, often yielding more than one million living specimens per cubic meter, and they live in all marine habitats from intertidal to deepest ocean, from tropics to poles. Their mineralized tests preserve well, so a small sediment sample is likely to provide a large and statistically valid assemblage. They do not, however, live in freshwater environments, and only a few species live in brackish contexts. Further, individual species are highly specific to environment and are quick to respond to environmental change. Thus, foraminifera are highly

useful for determining a range of paleoenvironmental characteristics, including sea-level change, paleoclimate, temperature, salinity, carbonate chemistry, diet, and nutrient conditions (Marriner and Morhange 2007: 170).

In the laboratory, fossil organisms are extracted and assigned to general ecological assemblages or *biofacies*, such as freshwater, brackish lagoon, marine lagoon, coastal, and marine. These categories are determined, as explained above, on the basis of the environmental tolerances of the species present, but also by *geochemical analysis* to determine the stable isotope ratios of oxygen and carbon in the shells of ostracods and foraminifera. The ratio of the two stable isotopes of oxygen, ^{16}O and ^{18}O, in ocean waters is a function of global evaporation rates, which in turn are proxy measures for long-term climate fluctuations as well as water temperature and salinity (for principles, see Rapp and Hill 1998: 104–105). This ratio is also recorded in the shells of fossil marine and freshwater organisms because the shell is formed by the precipitation of carbonates from the surrounding water. The $^{18}O/^{16}O$ ratio, expressed as variance from present mean sea water ($\delta^{18}O$ in parts per thousand [‰]), is determined mainly by the temperature and salinity of water; negative values record progressively depleted ^{18}O and consequently warmer and less saline water, while positive values reflect enriched ^{18}O and colder, more saline water (Deith 1988). Similarly, the ratio of the two stable isotopes of carbon, ^{13}C and ^{12}C, imparts information about temperature and salinity as well as the presence of carbon from decomposed plants. When stable isotope ratios are combined with the species' ecological preferences and tolerances, the depositional environment can often be determined conclusively (e.g., Goodman et al. 2009).

The ultimate aim of geoarchaeological analysis of paleocoastal environments is to identify the changing coastal environments of deposition, or *facies*, over time. Facies are defined as the characteristics of a rock unit (in this case, a sedimentary deposit) that reflect the condition of its origins and differentiate it from adjacent units. Each sedimentary facies identified in the core has an essentially uniform character that reflects its origin and distinguishes it from adjacent units laterally and vertically (Rapp and Kraft 1994: 72). Biofacies derived from microfaunal analysis are correlated with sedimentary facies resulting from the granulometric analysis (Fig. 5.12). The chronometric framework for the sedimentary sequence is usually provided by radiocarbon determinations on organic material present in the core, including shells, charcoal, wood fragments, peat, charred roots, and other plant remains. Datable sherds can also provide chronological information. When a number of sediment cores are taken across a coastal landscape, the sedimentary units can be correlated to construct a broad record of changing coastal landforms over time.

The work of Besonen and colleagues in the lower Acheron River valley provides an example of facies designations (Besonen et al. 2003). On the basis of

Facies/surface name	Definition	Diagnostic sedimentology	Diagnostic biostratigraphy
Harbour Abandonment Facies (HAF)	- Degradation of harbourworks and exposure of the basin	- High to middle energy aggradational and progradational sets - Coarsening-up sequence	- Juxtaposition of diverse ecological groups (translate the exposed nature of the depositional environment
Harbour Abandonment Surface (HAS)	- (Semi)abandonment of the basin	- Transition from fine-grained harbour silts and clays to coarse sands and gravels	
Ancient Harbour Facies (AHF)	- Anthropogenically forced low-energy sedimentary environment	- Transition from coarse beach sands to fine-grained harbour silts and clays - Rapid fine-grained sedimentation rates (10-20 mm/yr) - Granulometric heterometry	- Ostracods = *Cyprideis torosa Loxoconcha* spp., *Xestolebris* spp. - Foraminefera = *Ammonia* spp. - Mollusc = *Parvicardium exiguum Loripes lacteus, Cerithium vulgatum*
Harbour Foundation Surface (HFS)	- Natural to artificial interface	- Abrupt change from coarse beach sands to fine-grained harbour silts and clays	
Proto-harbour sands / Pre-harbour sands	- Natural beach sediments	- Aggradational coarse to medium grained sands - Coarsening-up sequence	- Coastal and semi-protected sub-tidal taxa
Maximum Flooding Surface (MFS)	- Marine flooding of the coastal sequence (ca. 6000 BP)	- Transgressive sands and pebbles	- Coastal and semi-protected sub-tidal taxa

5.12 Correlation of biofacies and sedimentary facies in the Ancient Harbour Parasequence. Reprinted from Marriner and Morhange 2007: 177, fig. 31, with permission of Elsevier.

geoarchaeological fieldwork using the techniques described above and others (Besonen et al. 2003: 209), they identified 14 distinct sedimentary facies on the modern landscape, which correlate to paleoenvironments that existed at one time or another in the Holocene (Table 5.1). They divide the facies into two broad depositional systems: the fluvial depositional system, consisting of the sedimentary environments landward of the shoreline, and the deltaic nearshore system, comprising those seaward of the shoreline but within the marine embayment (Besonen et al. 2003: 212–16). These data, combined with an array of radiocarbon dates from core material, allowed for the reconstruction of coastline configuration and coastal environments over time (Besonen et al. 2003: figs. 6.13–6.15). Because the terminology used to name these facies is not standard across the Mediterranean, it can take some effort to work out the correlations from one site to another.

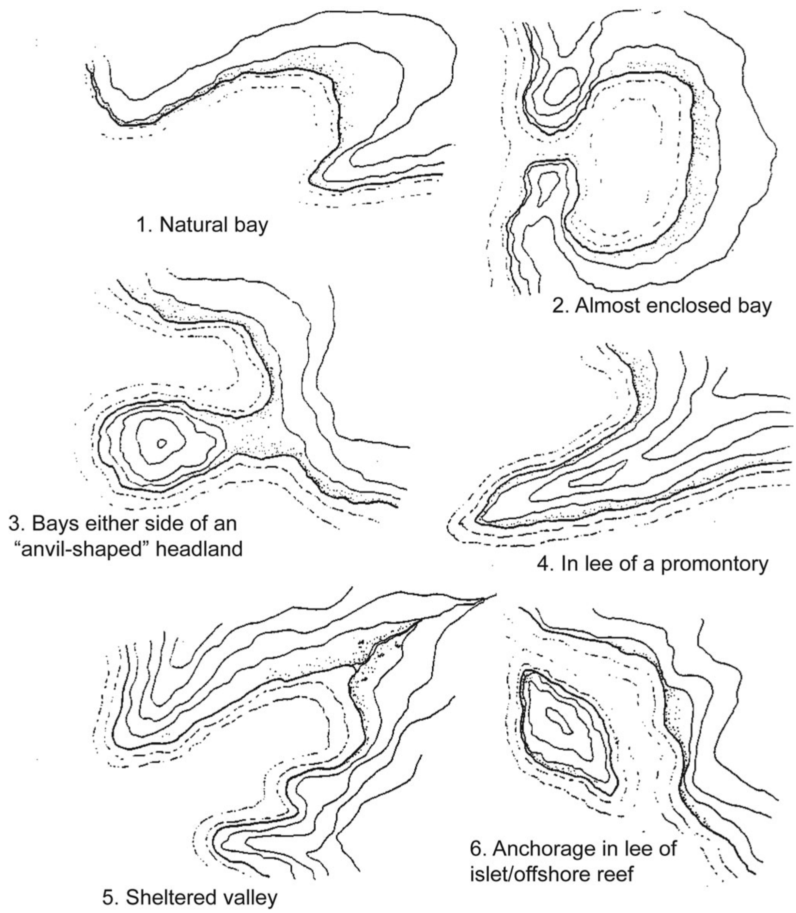
Table 5.1. Sedimentary facies in the lower Acheron valley (Besonen et al. 2003: 213–16)

Facies	Main component(s)
(1) River channel	Coarse lag deposits and bars
(2) Subaerial natural levees	Ridges of coarse and muddy sand formed by deposition of coarse overbank deposits
(3) Crevasse splays	Sand- to mud-sized flood deposits
(4) Floodplain	Flat ground adjacent to river channel, mainly silt- and clay-sized flood deposits
(5) Backswamp	Transitional zone between floodplain and shallow lake; perpetually saturated, organic-rich muds and clays; freshwater ostracods
(6) Shallow freshwater lakes and pools	Clay-sized particles; sparse freshwater ostracods and gastropods
(7) Delta-top marsh (fresh to brackish)	Organic-rich peat and peaty mud; brackish and freshwater microfauna
(8–10) Active delta front: distributary channel; distributary mouth bar; subaqueous levee	Continuity of subaerial natural levees underwater; particle size ranges from sand and sandy gravels (delta distributary channel) to sand and silt (subaqueous levee); brackish to marine microfauna
(11–12) Lower delta front; prodelta	Basinward of active delta front; low organic; coarser deposits than active delta front; brackish to marine microfauna
(13) Interdistributary bay	Shallow open body of water; silts and clays; abundant brackish to marine microfauna
(14) Concentric accretionary beach ridge and swale sets (see Fig. 5.3)	Facies (7)–(9) provide constant source of sandy sediment reworked by wave action, then piled over regular wave deposits by spring and winter storm waves and kept in place because Phanari Bay too well sheltered for longshore currents to entrain them

Classification of Bronze Age Harbors

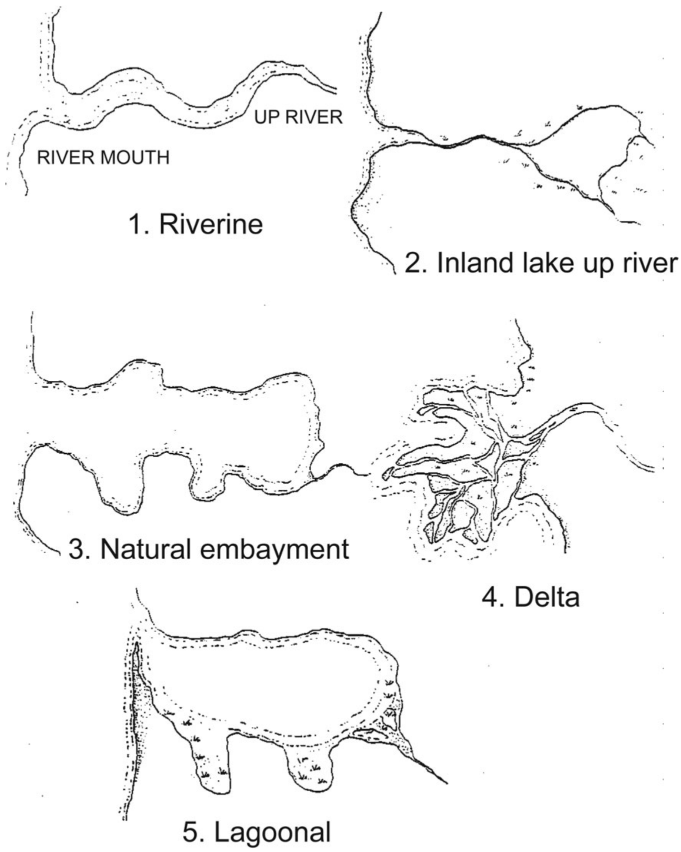
Several typological schemes have been developed to classify ancient anchorages and harbors. Generally, archaeologists have offered typologies based on idealized coastal topography *projected to the time of use in antiquity* (e.g., Blue 1997; Chryssoulaki 2005; Raban 1991; Shaw 1990), while geologists use geomorphological formation and history as the main criteria (e.g., Marriner and Morhange 2007).

Lucy Blue (1997: 31–34: figs. 1, 2), basing her typology on previous work by N. C. Flemming, distinguishes two categories of Bronze Age anchorages: those on high-energy, cliff-lined coasts, and those on low-energy, low-lying coasts. Anchorages on the former occur in (1) natural bays; (2) almost enclosed bays; (3) bays on either side of an anvil-shaped headland; (4) lee of a promontory; (5) sheltered valleys; and (6) lee of offshore islands or reefs (Fig. 5.13). On the



5.13 Topographic typology of Bronze Age anchorages: high-energy coasts. Drawing by Felice Ford after Blue 1997: 33, fig. 1.

latter, anchorages are found (1) on the banks of navigable rivers that empty into the sea; (2) in inland lakes upriver; (3) in natural embayments; (4) in river deltas; and (5) in lagoons or estuaries (Fig. 5.14). Blue's typology takes into consideration not only coastal configuration and landforms but also systemic energy; her distinction between high- and low-energy environments correlates fairly well with Wells' (2001: 150) first-order division of open versus protected coastlines. Other published descriptions of the range of Aegean or eastern Mediterranean anchorages are less detailed or are not typologies per se. Stella Chryssoulaki's (2005: 82–83, fig. V) typology is much simplified relative to Blue's and focused more narrowly on landforms rather than processes, but she does explicitly address certain features, such as sunken peninsulas and tombolos, which are particularly relevant to Minoan Crete. Using Blue's topographical typology, it is possible to assign a number of Aegean anchorages to one of her types (Table 5.2).



5.14 Topographic typology of Bronze Age anchorages: low-energy coasts. Drawing by Felice Ford after Blue 1997: 34, fig. 2.

Geomorphologists Marriner and Morhange (2007: 146–62, figs. 7–9) propose a complex harbor classification based on four variables: (1) proximity to the modern coastline; (2) position relative to sea level; (3) sedimentary environments; and (4) taphonomy (how a harbor came to be fossilized in the sedimentary record). According to this typology, there are buried urban, buried land-locked, buried lagoonal, buried fluvial, submerged, uplifted, and eroded harbors (Marriner and Morhange 2007: fig. 7). These can further be organized as lying on unstable coasts (those exhibiting tectonic subsidence or uplift) or stable coasts (all others, not affected by tectonic activity; Marriner and Morhange 2007: fig. 8). Another geomorphological perspective is preservation potential: buried harbors have good preservation potential by virtue of being buried; uplifted and submerged harbors have medium preservation potential; and eroded harbors have poor preservation potential (Marriner and Morhange 2007: fig. 9).

The advantage of geomorphological typologies is that they are ostensibly based on fieldwork that has established the diachronic history of deposition,

Table 5.2. Mediterranean anchorages associated with topographical types

	Topographic type	Mediterranean examples
High-energy	Natural bay	Zakros, Souda (Crete)
	Almost enclosed bay	Mezapos, Kiparissi (Laconia)
	Bays either side of anvil-shaped headland	Pseira (Crete); Ayia Irini (Kea); Vayia (Corinthia)
	In lee of a promontory	Many, depending on wind direction
	Sheltered valley	Ayiofarango (Crete), Vathi (Matala, Crete)
	Anchorage in lee of islet or offshore reef	Amnisos, Kommos (Crete)
Low-energy	Riverine	Israeli coast
	Inland lake up river	Acherousian Lake (Epirus, post-Bronze Age); Enkomi *Ayios Iakovos* (Cyprus)
	Natural embayment	Many bays and gulfs, e.g., Glykys Limin (Epirus); Latmian Gulf (western Anatolia)
	Delta	Nile Delta; Cilician Delta (southern Anatolia)
	Lagoonal	Western Peloponnesian coast (Elis, Messenia); Hala Sultan Tekke (Cyprus)

erosion, and movement of the shoreline. This is not to say that these geomorphological reconstructions cannot be misleading or wrong, as the case of Kition-Bamboula (Morhange et al. 2000) demonstrates. As mentioned above, archaeological discussions of ancient coastlines that retroject modern topography into the distant past without careful consideration of geomorphological history, or that fail to present explicit evidence for proposed configurations, must be treated with caution. Blue's topographic typology is based on an understanding and application of geomorphological principles, but in the wrong hands the typology can make it seductively easy to simply match modern satellite images of coastal areas, which are so easily accessible online, with these idealized types. The topographic and geomorphological typologies are complementary data sets that should be used in combination.

A Systematic Approach to Detecting Bronze Age Harbors

The investigation of ancient harbors is by definition both a geoarchaeological problem of coastal landforms and processes, and one that requires more traditional means of terrestrial and underwater archaeology. In view of the rich geomorphological scholarship on the Mediterranean and the availability of interested coastal geomorphologists, there is no justifiable philosophical impediment to systematic, joint archaeological–geomorphological programs to detect ancient anchorages in a narrow sense, and more broadly to investigate

Bronze Age coastal worlds. These investigations are interdisciplinary as is all good archaeology, and they involve terrestrial and maritime fieldwork proceeding hand in hand. There are abundant models for the implementation of pedestrian survey (e.g., Banning 2002; Cherry et al. 1991; Tartaron et al. 2006), terrestrial excavation (e.g., Drewett 1999; Hodder 1998), and underwater survey and excavation focused particularly on shipwrecks (e.g., Gould 2000: 21–64; Muckelroy 1978: 24–58), but the real need going forward is for the design of programs of close collaboration between archaeologists and geoarchaeologists from inception to interpretation.

Models of integrative research, relying on constant collaboration across disciplines in the field and "intensive exchange of information, ideas, and procedures from the planning stage through final publication" (van Andel 1994: 28), are at hand in the eastern Mediterranean. The renewed excavations at Çatalhöyük by Ian Hodder and colleagues practiced a "reflexive archaeology" that assembled specialists from diverse disciplines to observe the recovery of material "at the trowel's edge" (Farid 2000; Hodder 1997, 2000). The Eastern Korinthia Archaeological Survey (EKAS) applied a comparable philosophy to pedestrian surface survey by integrating experts from all participating disciplines in each stage and in every aspect of the project (Tartaron et al. 2006: 463–64). The fieldwork application of this philosophy entailed the "embedding" of geomorphologists in archaeological survey teams, and archaeologists with teams engaged in geomorphological mapping and soil description. The atmosphere of mutual enlightenment engendered by shared research allows collaborators to gain a realistic understanding of the opportunities, limitations, and reasonable outcomes of each others' fields. The goal as applied to coastal research is to pool the acquired knowledge in order to learn about the human and natural interface of land and sea, in the service of a broader, more holistic study of maritime cultural landscapes; in the words of Ina Berg (2010: 21), " . . . an inclusive archaeology of islands, sea and coasts." But, as Berg cogently emphasizes, this is not merely a matter of cross-disciplinary communication, but instead requires a commitment to breaking down the conceptual divide between land and sea that has characterized Mediterranean maritime archaeology (see Chapter 6).

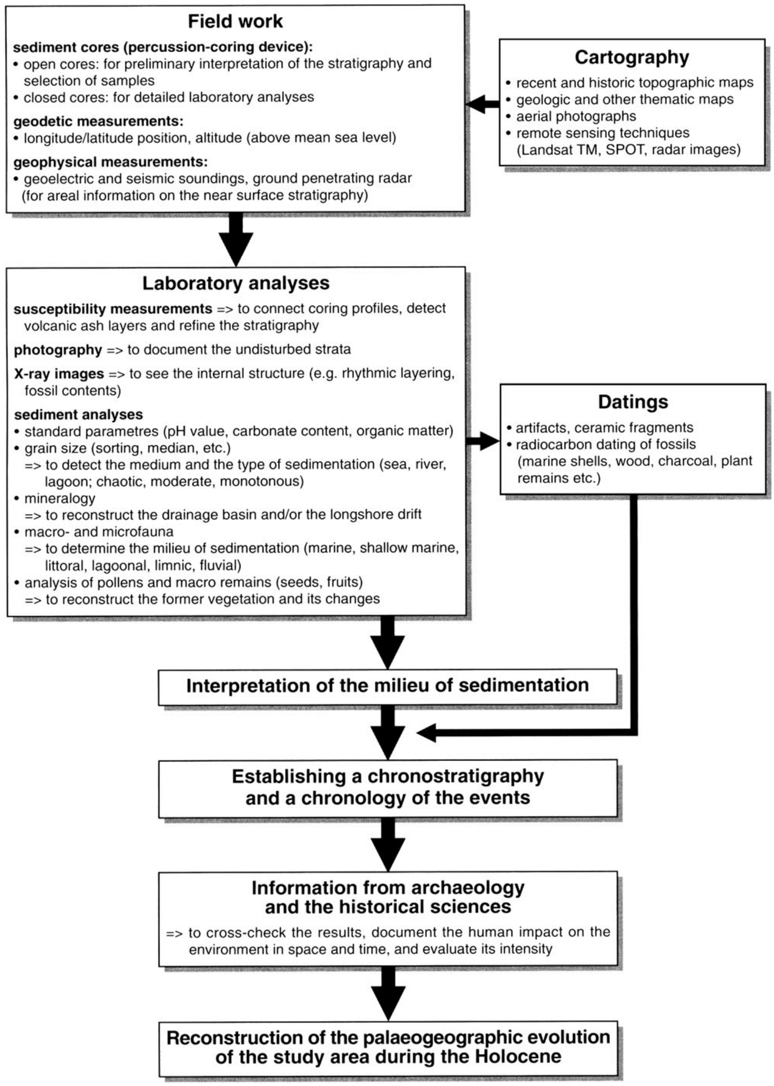
Like any archaeological investigation, a joint archaeological–geomorphological program of coastal research should proceed by a sequence of coherent, logical steps (Fig. 5.15). One might begin, as the present study did, with a vexing problem (where are the Mycenaean-era anchorages?), or any set of compelling, carefully defined archaeological or anthropological questions that can be applied to a geographical and chronological horizon of interest. The precise study area can be refined based on the research questions and tempered by constraints of time, money, and permit restrictions. The research questions should be formulated in an explicit theoretical framework (as we know, all archaeological research has a theoretical orientation, whether acknowledged or not), from

which a series of testable hypotheses can be generated. From these preliminary deliberations, appropriate search strategies and field methods can be developed. For coastal projects, archaeological and geomorphological fieldwork may occur both on land and in/on the sea.

Strategies for the initial discovery of Bronze Age anchorages in a survey universe (a long coastline, for example) of relatively unknown site potential can make use of a host of distinctive approaches, such as the following:

(1) Investigation of known historical harbors; many have earlier histories as natural anchorages of the Bronze Age or Early Iron Age (e.g., Sidon, Tyre, Liman Tepe).
(2) Examination of modern natural anchorages to test, through geoarchaeological means, whether they existed as suitable anchorages in the Bronze Age.
(3) Focus on deltas and river mouths. Because these were favored as natural harbors in the Bronze Age, programs of geological coring may recover evidence of buried deltaic and estuarine systems of that age.
(4) Collection of information from local inhabitants, who often know of coastal and underwater archaeological sites. In addition, oral histories and archival data giving evidence of human activities in historical and modern times can provide analogies and insights into emic perceptions of maritime cultural landscapes (see Chapter 7).
(5) Intensive geomorphological and archaeological surface survey along the entire littoral zone of the study area to assess evidence for coastal landforms and to recover traces, however abundant or sparse, of human activity (with selective excavation, where possible, occurring at a later phase).
(6) Systematic search based on models of coastal exploitation. The Coasts and Harbors Survey, a subproject of EKAS, developed a GIS-driven probabilistic model for prehistoric harbor locations based on environmental and cultural variables (Rothaus et al. 2003; Tartaron et al. 2003). Groundtruthing the model resulted in the discovery of two major Bronze Age anchorages at Vayia and Kalamianos on the Corinthia's Saronic coast, and subsequent geoarchaeological investigation and archaeological prospection over the years has generally validated the principles and results of the model. In a different way, geoarchaeological analysis of the coast of Elis led to predictive statements about the locations of buried Bronze Age sites and coastal landforms (Kraft et al. 2005). In both cases, a Bronze Age coastline has been partially reconstructed from a modern littoral virtually devoid of recognizable anchorages, a first step to reconstituting humanized coastal worlds.

Other discovery strategies, not generally practiced in the search for Mediterranean Bronze Age anchorages, are prominent elsewhere. In Scandinavia, the preferred methodological tools are phosphate analysis and place-name studies



5.15 Flow chart of methods in geoarchaeology and paleogeography. Brückner 2003: 126, fig. 2. Courtesy of Springer Science+Business Media.

(Ilves 2009; Westerdahl 1992: 9–11). The method of identifying coastal settlements by detecting dark soils with high phosphate content, followed by test pitting, was established already in the early decades of the twentieth century by Olof Arrhenius (Ilves 2009: 154), but has been little attempted in the Mediterranean (the so-called stables at Gla are an exception: Iakovidis 1989, 2001). Similarly, the use of the many place names with transparent or plausible associations with maritime activity, as well as old maps and charters, to find harbors, is a significant element in Scandinavian maritime archaeology because of the primary focus on historical (Viking Age and later) periods. As we have seen, the

names of relatively few Aegean Bronze Age settlements are known, and none has a transparent linguistic association with the coast or sea.

Liman Tepe, Aegean Turkey: A Brief Example

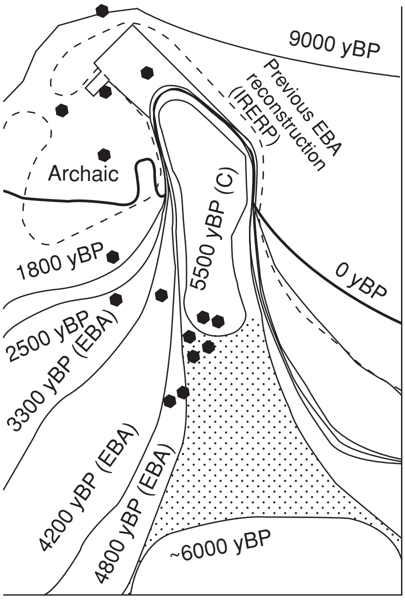
Recent research in the Bay of Izmir region of Aegean Turkey provides a compelling example of integrative research and a striking demonstration of the need for comprehensive geoarchaeological investigation to properly reconstruct ancient coastlines and harbors. The coastal settlement at Liman Tepe was a significant Bronze Age center, and in later times the site of the Ionian city of Klazomenai. Liman Tepe was particularly important in the EBA, when a fortified citadel was built. Finds from the limited excavations to date within the settlement have revealed a vigorous local culture with strong ties to other areas in the Aegean Islands and the Greek mainland, as shown by imported pottery as well as an architectural complex that may have functional affinities with the "corridor houses" of the EH II Aegean (Şahoğlou 2005).

From the archaeological and historical information, it was assumed that a major harbor was located at Liman Tepe, but until the late 1990s, paleocoastal reconstructions were limited to interpretations of modern topography and the distribution of archaeological materials from surface survey. Based on information from these two sources, it was believed that in the EBA, a large part of the enclosure wall, now submerged, extended to the north and in the northwest formed a large pier with an attached built breakwater, preserved as a ruined underwater structure (Şahoğlou 2005: 98; Fig. 5.16). It was also thought that the later Archaic-period harbor occupied a large embayment delineated by the distribution of surface and near-surface architecture and artifacts (Ersoy 1993).

Because these reconstructions relied on tenuous data, a new archaeological and geoarchaeological program was begun in 1999 and continued in years following, featuring underwater excavations and a multiproxy geoarchaeological study (Goodman et al. 2008, 2009). The geoarchaeological data set was derived from terrestrial cores, sea-bed cores, and grab samples from the walls of the underwater excavation trenches. These materials were subjected to microfaunal analysis of shells, foraminifera, and other microfossils to determine presence/absence, ubiquity, and species and their environmental tolerances; grain size analysis; determination of $\delta^{18}O$ and $\delta^{13}C$ values relative to local sea water; presence/absence of archaeological materials; radiocarbon dating; and chronological and stratigraphic association of deposits (Goodman et al. 2008: 1270–72, 2009: 97–98). Using these proxy measures, the researchers were able to identify the following environmental facies: terrestrial, supratidal, wetland, foreshore, lagoon, upper shoreface, and *artificial* harbor basin (Goodman et al. 2008: 1272–77, 2009: 98–100).

5.16 Location of Liman Tepe in the Bay of Izmir region. Satellite image © 2011 Google Earth, © 2011 Digital Globe.

The historical interpretations engendered by these results conform in important ways to current understandings of long-term regional processes in the eastern Mediterranean, but explicitly contradict the previous reconstructions of the ancient coastline at Liman Tepe (Goodman et al. 2009: 100–102). The data are in basic agreement with an early Holocene marine transgression, followed by eustatic sea-level-rise deceleration circa 6000 BP. The deceleration resulted in a positive sediment budget, and excess sediments were transported by longshore currents to form sandbars, and ultimately beach barriers with extensive lagoons behind them. It was during the EBA that an ideal combination of nearshore lagoons and a tombolo joining the mainland to an offshore island created several natural, sheltered contexts to anchor or beach seafaring vessels. By the end of the LBA, however, these longshore sediments isolated the lagoons from the sea, as indicated by a change from brackish-marine to fresh water, ending the viability of Liman Tepe's harbors (Fig. 5.17). There is no evidence for a harbor of any kind for centuries thereafter, until artificial harbor constructions were first built circa 800 BC. During this Early Iron Age interim of at least 200 years, archaeological evidence indicates a diminished community with few maritime connections.



5.17 Reconstruction of the Bronze Age coastline at Liman Tepe. Goodman et al. 2009: 102, fig. 3B. Courtesy of John Wiley & Sons, Inc.

It is of particular importance that the geoarchaeological study allowed the investigators to reject the previous coastal constructions (Goodman et al. 2009: 101–103). The submerged built feature was associated not with the EBA, but with the much later built harbor of the Archaic and Classical period. This finding is significant because, along with the revelation that a number of natural anchorages existed along the EBA coastline, it helps to sustain the notion that built harbor constructions were rare or absent in the Bronze Age Aegean. Earlier reconstructions also showed a broad bay east of Liman Tepe in classical times (Ersoy 1993; Goodman et al. 2009: fig. 1), but the geomorphological data demonstrate that such a bay existed only in the EBA.

The implications of these results are clear for understanding the history of the site and its maritime connectivity over time. Once again, we see that however meticulous or well intentioned, reliance on modern surface topography or archaeological patterns often leads to flawed reconstructions. Thus, the geoarchaeological study of Liman Tepe's paleocoastline offers a strong argument for the type of interdisciplinary work advocated in this chapter. Additionally, as Beverly Goodman and colleagues (2009: 103) point out, the Liman Tepe study presents a contrast to previous studies in western Anatolia focused on sites at the mouths of large rivers, such as Ephesus or Troy. It illustrates that major coastal change occurs also in less dynamic environments, even in the absence of plentiful sediment supply from an alluvial source. This point of view is especially germane as the scale of analysis moves toward finer-grained, local coastal contexts.

Conclusion

In this chapter, I have attempted to address critically the widely held impression that the land masses of the Greek mainland and Aegean Islands have been essentially stable over the period from the Bronze Age to the present. By necessity, I have emphasized the physical and environmental characteristics of coastal settings. In the next chapter, I present theoretical perspectives that emphasize the social aspects of living in coastal and maritime settings. Thereafter, the physical and social-symbolic background will be firmly in place, and the two distinct approaches can be joined in the case studies of Chapter 7.

SIX

CONCEPTS FOR MYCENAEAN COASTAL WORLDS

> The ensemble of Mediterranean lands . . . has an inside-out geography in which the world of the sea is "normal" (the interior), and the land is the fringe, its marginality increasing with its distance from the water. (Horden and Purcell 2000: 133)

Having presented arguments for the recovery of the physical spaces of ancient coastlines, I seek in this chapter to integrate the spatial, temporal, and social dimensions of coastal dwelling in a broader conceptual framework that emphasizes networks of interaction. Such a framework must be dynamic: it must accommodate expansion and contraction of networks, reconfiguration in the number and location of nodes in a network, and multiple and overlapping networks operating at different geographic and temporal scales and serving different purposes. These changes and adjustments can be influenced by environmental and technological factors, but to a much greater extent they are determined by political, economic, and social relationships (e.g., Horden and Purcell 2000: 53–88). On the most fundamental level, however, the conceptual framework should address whether the coastal mode of existence is sufficiently distinctive to merit theoretical consideration as an entity or category in its own right. I begin, therefore, with a discussion of how coastal people are positioned relative to the worlds of land and sea around them, and how consequently they played a special role in the connectivity of the Mycenaean world. Subsequently, I present a framework for Mycenaean maritime connectivity based on several conceptual categories related to scales of interaction. Finally, I explore how this framework can accommodate current ideas about connectivity and social networks.

The Unique Status of the Coastline?

Life in the twenty-first century can color one's view of movement about the landscape, particularly when one's point of reference is the hyper-developed "first world." The elaboration of an infrastructure of roads, railways, and airports has marginalized sea travel for most people, and this change has affected Greece as much as any other European country, despite its long association with the sea. The ability to travel safely around Greece on good roads has minimized sea travel and has located coastal areas in a conceptual periphery: coastlines are now destinations to which one drives on occasion to escape the rigors of continental life. Most sea travel consists of short jumps from mainland to island or island to island while on holiday. But in the LBA this relationship is likely to have worked in the opposite way. It is commonly observed that in antiquity it was easier to travel around the Greek mainland by sea than by traversing the rugged interior. This principle calls attention to the virtual lack of built roads in the Bronze Age (those around Mycenae being the primary exception), the limited hauling capacity of humans and pack animals over rough tracks relative to the considerable cargo capacity of ships such as those recovered at Uluburun and Gelidonya, and the fact that few locations on the mainland are far from the sea. Though true enough, this principle predictably threatens to become an overcorrection that underestimates overland traffic, which must have been continuous and perhaps even predominant in months when sailing was difficult.

An even more obvious point is that nodes in a maritime network are coastal, and for this reason alone coastal places and people are essential to any network analysis that involves connections by sea. But can we say more? Can we mark out a distinctive role for coastal people that transcends mere geography to convey something meaningful about the implications of inhabiting the coast during Mycenaean times? I think it is possible by re-centering the coastline, and to do this it is necessary to embrace the notion that webs of interaction articulate coastal dwellers to both land and sea.

The first step is to recognize the simultaneous *liminality* and *centrality* of the coastline. The coast occupies a physically liminal space at the interface of land and water. Coastal people occupy an ecotone – a transition between contrasting ecological zones and their productive resources. This liminality is both economic and social; that is, the shore is the space where people and products from the interior meet those arriving by sea. Coastal communities play a mediating role in these encounters, and the coast becomes a central – not merely liminal and certainly not peripheral – place. As implied in the quote opening this chapter, it is inland people who have the greater challenge establishing and maintaining connectivity in a Mediterranean setting such as the Aegean. In Chapter 7, oral histories from inhabitants of the modern village of Korphos will be used

to illustrate the ways that coastal people may manipulate their centrality in economic transactions.

There are several implications of the centrality of coastlines. People inhabiting them need not be oriented to the sea, but it may be impossible to escape this orientation when the sea offers resources and brings other people, wanted or unwanted. Coastal dwellers are in a sense amphibious since they become adept at negotiating both land and sea, and mediate between terrestrial and maritime worlds. They possess distinctive and specialized knowledge about how to negotiate local winds, weather, and other navigational hazards. In a more figurative sense, coastal areas have been central to history and tradition as the settings for armed conflict, whether we invoke the coastal raiding of the *Odyssey* or the great battles at Troy, Marathon or Thermopylae, or Navarino. The recurrent raids and invasions suffered by coastal settlements mark them as exposed and vulnerable. Fortified coastal settlements such as those of the EBA Aegean reflect both a maritime orientation and the need to protect communities from the dangers of piratical raids.

Although I stop short of advocating subdisciplinary status for coastal archaeology, I do suggest in this book that coastal areas are sufficiently unique in their geomorphology, geographic position, and interactive potential that they merit special study. It may be useful to draw a brief comparison with "island archaeology" in the Mediterranean. Broodbank (2000) explicitly called for an island archaeology approach that focuses on Aegean-scale connectivity and interaction, while rejecting then-prevalent notions of insularity and island biogeography that treat individual islands as isolated "laboratories" for cultural evolution (inspired of course by the studies of Darwin and his successors on the effects of isolation in biological evolution on islands; see Cherry 2004: 241–45; Patten 1996: 1–5, 19–34). In a remarkable bit of irony, Paul Rainbird in his *The Archaeology of Islands* (Rainbird 2007) argues against the very concept of island archaeology. While supportive of Broodbank's general approach, he rejects the commitment to islands as units of analysis as a "fatal flaw" (2007: 43). He instead favors a theoretical shift to an archaeology of the sea that encompasses islands and the littorals of mainlands as a complement to archaeology on land, as well as a shift away from emphasis on the material and environmental record to the postprocessual project of trying to recover the lives and perspectives of mariners and coastal dwellers. The coastal archaeology that I advocate draws something from both; specifically, Broodbank's stronger commitment to empirical evidence (both environmental and cultural), and Rainbird's interest in teasing out the individual and (especially) the maritime community. I make no a priori distinction between coastal communities situated on mainlands and those on islands, because the coastline always unites land and sea, and because the way that a coastline functions does not strictly depend on its mainland or island location. Small islands may comprise little more than coastline without a

significant terrestrial hinterland, but that situation is simulated on Greek continental coastlines where a narrow coastal strip is backed by a rugged, mountainous interior. Similarly, the experience of coastal dwelling on larger islands may not be fundamentally different from that on continental coastlines. I follow both of these scholars in advocating an approach that encompasses maritime, terrestrial, and coastal, while placing particular emphasis on the distinctiveness, analytical potential, and historical significance of the coastal zone.

A Framework for Maritime Cultural Landscapes

The concept of the *maritime cultural landscape*, coined and subsequently developed by Christer Westerdahl, is widely cited and used as a framework for discussion of maritime interaction, but its application is somewhat problematic in that it remains highly generalized and ambiguous.[1] The maritime cultural landscape, according to an early translation into English, "... comprises the whole network of sailing routes, old as well as new, with ports and harbours along the coast, and its related constructions and remains of human activity, underwater as well as terrestrial" (Westerdahl 1992: 6). Although Westerdahl recognized the "immaterial, cognitive or indicatory" aspects of maritime life, for him these were preserved mainly in place names (Westerdahl 1992: 6). Such a definition encompasses virtually everything with little consideration of variability or scale – it could equally describe a local or an international network, a Bronze Age or Medieval world – and gives insufficient scope to the immaterial cultural dimensions of living and moving within maritime landscapes. In later writing, Westerdahl increasingly incorporated experiential and cognitive elements, but this did not fundamentally change the broad-brush quality of his concept. The tendency of landscape studies to ambiguity about the nature of what landscape is, or can be, and the proliferation of often conflicting definitions of landscape, have been noted as both a strength – as a capacious space for theoretical exploration and interpretation – and a weakness since a lack of clarity inevitably attenuates the force of the concept (Duncan 2006: 10–11).

Rather than bending the concept of maritime cultural landscape to my particular purposes, I propose to allow it to stand as an all-embracing foundation onto which I will construct an explicit framework for Mycenaean maritime connectivity that is based on nested scales of interaction from local to international. This multiscalar framework, summarized in Table 6.1, requires some general explication before each category is examined in turn. The hierarchy inherent in this framework is purely geographical and does not necessarily imply hierarchical relations of power. For example, a maritime small world composed of a number of coastscapes may be persistently controlled politically or economically by a powerful entity, or it may be heterarchical – that is, lacking a hierarchy of power or susceptible to changing hierarchical relationships over time.

Table 6.1. A framework for Mycenaean maritime cultural landscapes

Sphere of interaction	Geographical scale	Temporality	Operators	Typical vessels	Evidence	Typical modes of exchange
Coastscape	Territorial coastal zone; passes to interior; inshore waters and the visual seascape	Everyday life	All: specialists and nonspecialists	Fishing boats; pilots; coasting vessels	Akrotiri fresco boats; Mitrou boat; Cretan seals; boat models	Home-base and boundary reciprocity (inland and maritime)
Maritime small world	Many coastscapes, connected by no more than two-day round trip; depends on topography	Habitual	All: specialists and nonspecialists	Fishing boats; coasting vessels; small cargo vessels	Pseira wreck? Point Iria wreck? Akrotiri fresco boats	Home-base and boundary reciprocity, central-place market
Regional/ intracultural maritime sphere	Aegean basin; depends on technology and development of intracultural relations	Relatively infrequent	Specialists	Seagoing cargo vessels; galleys	Pseira wreck? Point Iria wreck? Fresco boats: Akrotiri Pylos, Iklaina	Boundary reciprocity, down-the-line, freelance
Interregional/ intercultural maritime sphere	Outside Aegean basin and Mycenaean maritime culture area; depends on technology and development of intercultural relations	Infrequent	Specialists	Seagoing cargo vessels; galleys	Uluburun wreck; Gelidonya wreck; LH IIIC painted pottery (galleys)	Down-the-line, freelance, emissary trading, colonial enclave

Further, leaving aside political power, interaction at any of these scales need not imply long-term stability as a social or economic network. The physical and social boundaries between these categories are fuzzy and prone to change as networks are modified by internal and external forces; they may expand or contract, solidify or fragment, be impermeable or porous. Normally, cohesion should decrease with the increasing geographical scope of an interaction sphere; a central assertion of Chapter 4 was that local networks are more stable and permanent than long-distance ones, and thus interregional and intercultural networks would be expected to be the most vulnerable to change. Yet social network theory (see below) predicts that "shortcuts" can expand networks and make longer-distance connections more efficient, and at any time two or more large, powerful sites with abundant resources may bypass local and regional networks to forge direct, long-distance connections.

As envisioned here, the spheres of maritime activity are nested geographically in increasingly larger webs of interaction, which together form the maritime cultural landscape of a particular cultural entity at a particular moment in time. As noted in Table 6.1, however, I also inject elements of temporality and maritime specialization to express the idea that as connections grow more distant, they will normally involve fewer trips and personnel from the local area, though connections made with distant places, whether indirect or direct, active or passive, may possess tremendous social significance (Broodbank 2000; Helms 1988; Sherratt and Sherratt 1991).

It may be convenient to characterize the maritime cultural landscape by reference to the largest sphere of interaction detectable at a given moment, since it can be assumed that societies engaged in interregional networks will possess intracultural networks and small worlds as well. Not all levels of interaction need exist at a given time, however: obviously, connectivity is more far-reaching in some eras than in others, and for certain expanses of time a coastal community may lack the ships and master sailors to actively participate in long-range voyaging. Furthermore, these coastal communities always respond in some way to the ebb and flow of the wider webs of communications around them. In periods when long-distance connectivity is limited by technology or interrupted by political conditions, maritime relations may occur predominantly or solely in the realm of small worlds and intracultural regions. Even under such conditions, goods and people may travel long distances, cutting across major geographic and cultural boundaries, but doing so in smaller segments. One thinks of the Aegean in EB II, when despite the limitations of human-powered seacraft, exotic and quotidian items circulated throughout the coasts and islands, most likely by coast- and island-hopping. The maritime cultural landscapes of these coastal inhabitants were situated entirely within the Aegean archipelago. The collapse of this vigorous connectivity in EB III reduced most interaction to a more local scale. Fluctuations in the scale of maritime connectivity, which might be read in

the archaeological record, allow for diachronic reconstructions that lend flexibility and historicity to the multiscalar framework. We would expect connectivity within the Mycenaean world to vary through time, moving through the many phases from the Shaft Grave Era to the postpalatial period; and by location in the diverse environmental and cultural settings of Greece. Although my approach privileges coastscapes and small worlds, these are clearly embedded in larger webs of connectivity, and influenced by events unfolding in distant places. In epistemological terms, I regard the finer-scale networks as building blocks in the archaeological process of recovering a more accurate understanding of how entire "world systems" work.

I turn now to defining the spheres of interaction that make up the Mycenaean maritime cultural landscape (Table 6.1). Although they are inspired by the conceptual categories of Horden and Purcell (2000), Broodbank (2000), Sherratt and Sherratt (1998), and others, they do not correlate exactly to any of these. My aim has been to make these spheres flexible, yet specific to the conditions of the LBA Aegean. They may not work particularly well when applied to other places and times, but similar principles might be used to tailor these concepts to any study of maritime connectivity.

Coastscapes

Coastscape refers to the coastal zone characterized by habitation and interaction, and by practice and perception. In the coastscape I include the following components: (1) the linear or convoluted shoreline and the adjacent coastal lowland that may be inhabited and exploited by maritime communities; (2) the connective routes and openings into the interior, which are often dendritic and follow natural paths connecting coast and hinterland (e.g., streams, mountain passes). The landward limit of the coastscape is often defined by ridges or mountains that block views to the interior and impede easy passage; (3) the inshore waters that are utilized on a daily basis for economic and social purposes; and (4) the visual seascape, the everyday field of view that defines the cognitive horizon in the seaward direction, in recognition of a continuous cognitive landscape for which the land–sea interface is no boundary. Hypothetically, therefore, the limits of the coastscape extend from the coast to the connective passes inland and the visible seaward horizon, but topography has much to do with the size and scope of a coastscape. The coastline may be short or long, and the coastal lowland ranges from narrow and relatively isolated from the interior, to broad and relatively open to the interior. The visual seascape may be a broad horizon, or it may be obscured by coastal ridges, offshore islands, or neighboring mainland. The visual seascape of one coastscape may overlap with that of others.

Coastscapes are instantiated by practice. Coastal zones are distinguished by the inhabitation of coastal communities, and by their maritime and terrestrial

activities. Everyday engagement with the sea involves fishing, local travel along the coast or to offshore islands, and pilotage and other interactions with ships and boats attempting to make landfall. The fishing boat and the coasting vessel, along with the pilot to assist larger ships to anchorage, would be characteristic of activity in the coastscape (Table 6.1). A coastscape may possess one or several anchorages, varying in size, depth, and exposure to winds and waves. It is a common practice in conditions of severe weather or strong winds to move boats from one anchorage to another nearby that is better protected, if one is available (Malkin et al. 2007: 1). Small anchorages may be used only seasonally or opportunistically to collect produce to be picked up by passing ships (Rothaus et al. 2003: 40), or as shelters from violent weather. The quality of a coastscape's harbors and anchorages for specific purposes plays a role, though not necessarily a determinative one, in its connectivity. Maritime activities occurring in the coastscape are understood to be nonspecialized in the sense that they do not require sophisticated navigational skills or knowledge of complex environmental phenomena. Within the confines of the coastscape and the small world, the part-time seafarer would possess adequate knowledge of nearby anchorages and their hazards, and it would not be overly risky to project good weather conditions for a trip lasting from a few hours to a day or two.

Coastscapes also witness a range of productive activities on land. Coastal settlements are rarely organized for maritime pursuits alone; land in coastal lowlands and accessible uplands is exploited, often heavily, for agricultural, pastoral, and wetland resources. These activities may not produce all of the goods required or desired by the community, which must as a consequence establish exchange relationships with maritime and inland partners. The movement of people and products between the coast and the interior has been documented as a pervasive mode of connectivity throughout antiquity, sometimes attaining a form of symbiosis. As at sea, routes and connections to the interior often overcome ostensibly formidable topographies; and like the visible features that mark a maritime network, routes may be indicated by villages, temples, and other monuments. Local guides may be needed to perform duties comparable to coastal pilots. New tracks to and through the interior are carved out in response to political conditions, for example to avoid taxes and hide from oppressors during the Ottoman period in Greece (Horden and Purcell 2000: 131).

Coastscapes share many properties of Horden and Purcell's "microecologies" and "microregions," but there are crucial differences. For Horden and Purcell, microregions appear to be aggregates of microecologies that may embrace coasts, lowlands, uplands, and interiors depending on existing environmental zones and, particularly, human efforts to integrate them.[2] Their examples of the Biqa valley of the Lebanon and the central Cyrenaica demonstrate as much (Horden and Purcell 2000: 54–59; 65–74). The Biqa also shows that their microregions can be completely inland, with little or no regular contact with the

sea. The coastscape, by contrast and by definition, centers on the shoreline and assumes a maritime orientation. The high mountainous areas and the interior zones beyond, forming an integral part of some of Horden and Purcell's microregions, lie beyond the realm of the coastscape. In marking this difference, I do not deny the existence or the significance of these broader interactive zones, and as mentioned above the interactions between interior and coast may be essential to sustaining maritime coastal life. Rather, the framework offered here is meant as an analytical and interpretive tool to address the particular problem of defining the nodes and networks of *maritime* connectivity. Coastscapes serve as these nodes, and through descriptions of them and of their variability across space and time, they become more than dots on a map or points on a graph of connectivity.

Maritime Small Worlds

The use of the term *small world* to describe a kind of social network is now widespread in sociology, anthropology, ancient history, and archaeology (e.g., Broodbank 2000: 175–210; Pullen and Tartaron 2007; Sherratt and Sherratt 1998; Watts 1999; Watts and Strogatz 1998), but as a concept it is defined and applied in various, sometimes incompatible, ways. Explicit definition is therefore essential, and my formulation of the small world follows from the logic of the maritime cultural landscape framework as the most local-level aggregation of nodes, that is, coastscapes. *Maritime small worlds* are interaction spheres that form as aggregates of many neighboring coastscapes; they might also be called *local worlds*. Their cohesion results from, and they are in fact constituted by, habitual face-to-face interaction based on proximity and various kinds of social and economic ties. The communities that make up a small world commonly share cultural traditions, language, social networks such as kinship ties and intermarriage, mutual protection arrangements, and dense economic relations. Often they are united by economic interdependence if resources are unevenly distributed or if subsistence is precarious.

As noted above, the political and economic organization of small worlds may be characterized by the presence or absence of hierarchy; often the horizontal ties of coastscape communities are more prominent than ranking or vertical hierarchies. In Chapter 7 we shall see how a Bronze Age small world in the Saronic Gulf oscillated between cohesion and fragmentation, and it will also be possible to consider economic hegemony as distinct from political control.

Intervisibility can be an important component of the cohesion of small worlds. Lines of sight are perhaps the most powerful integrative factor in the phenomenological world of a coastal dweller or mariner (Horden and Purcell 2000: 124–26). Chains of mutual visibility among coastscapes give an experiential impetus to the coalescence of small worlds, but universal intervisibility rarely

extends to an entire Aegean small world, owing to the mountainous and complex topography. Some landscapes lend themselves well to the formation of small worlds by their geography and topography, such as semi-enclosed gulfs like the Argolic and Saronic, or long facing coastlines separated by narrow straits, for example the eastern Greek mainland and the western coast of Euboea. Even under the ideal conditions of the Saronic Gulf, whereas Aigina is plainly visible from most coastal locations, parts of the gulf are always invisible from any coastal vantage point. In this case, visibility combines with the peculiar conditions of maritime travel within the confines of the gulf – in contrast to those encountered once outside – to demarcate, at least hypothetically, the outlines of a maritime small world.

Distance and travel time are also crucial variables in the definition of small worlds. Actual linear distance is relevant only in its general relationship to travel time; alone it is an insufficient measure of the effort required to maintain contact between two nodes. A more useful measure of distance is a travel time index that provides a travel path textured by the resistance of sea or land to progress, taking into account, at minimum, the effects of winds and currents. Maritime travel must take into account the common voyage that requires one day out, but four or five days return because of winds and currents. Carl Knappett and colleagues (Knappett et al. 2008: 1021) stress that actual travel times should replace physical distance as quantitative input in network models, but they were not able to quantify this variable in their first attempt (see below). David Conlin (1999: 179–84) presented a mathematical model to simulate the effects of wind and currents on travel time, and Justin Leidwanger (2011) has made a start at texturing the surface of the sea with wind and current data using Geographic Information Systems (GIS) software. Soon these various trajectories will surely converge so that we can systematically address observations such as that of Agouridis (1997: 19), who points out that environmental conditions can make islands in close geographic proximity "distant" in terms of potential for interaction.

Although travel time parameters are to an extent contingent on specific journeys, habitual face-to-face interaction places broad limits on scale. The geographic extent of a small world depends on the environmental configuration of the seascape (exposure to currents, waves, and weather patterns), seafaring technology, and strength of the relationships among members. These factors tend to be mutually reinforcing at the local level: the greater predictability of weather conditions for short-range journeys promotes access by sea, virtually year-round in many cases. Frequent contact facilitates the establishment of strong economic and social ties, potentially including kinship and social storage relations. As these relations develop, interaction becomes more frequent. Thus begins a history that, because of the density and strength of personal ties, may endure through the boom and bust cycles of larger-scale political and economic

entities. Durable is not the same as immutable, however. Small worlds are not immune to the effects of environmental shifts or catastrophes, internal conflict and power shifts, or external developments.

The maximum daily range of a Bronze Age sailing ship of between 100 and 150 kilometers (Broodbank 2000: 345, table 12; Knappett et al. 2008: 1014, opt for the lower figure of 100, which I follow here) should set the outer limits of what we might call "local," and thus the greatest expanse of a LBA maritime small world from end to end. Beyond this, we move into the realm of open-sea or night voyaging, with their requirements of advanced skills and knowledge and the higher probability of unfamiliar seas and coasts, as well as unforeseen weather emergencies. In practice, even if we imagine short hops on long itineraries, the norm for a small world should be smaller in scale. The fishing boat, the rowboat, and the coasting vessel would be more the rule than the large sailing ship, which might operate from a major harbor (Table 6.1). By contrast, smaller boats would require only informal anchorages offering a sandy strand, or even something like the innumerable tiny docks bearing the name *skala* (from the Italian *scala*) for the few rock-cut steps used to board a vessel (Constantakopoulou 2007: 222–23). Maritime travel within the small world would thus remain primarily in the realm of the nonspecialist.

Specific to the small world are three specialized applications of social and economic connectivity that are worthy of mention as distinctive of the Mediterranean: the phenomena of the "goat island"; the *porthmeutike*, or short-distance ferrying of goods, people, and animals; and the *peraia*, here defined as a coastal region controlled by an island lying opposite (Constantakopoulou 2007: 200–26).[3] Goat islands refer somewhat more generally than the name suggests to small, offshore islands and islets (inhabited or uninhabited) that are used to expand agricultural and pastoral production. These have been a prominent feature of Aegean seascapes since antiquity: Christy Constantakopoulou (2007: 200–14) documents many Aegean examples from ancient literary and epigraphic sources, beginning with Thrinacia, where Helios' cattle and sheep were pastured in the *Odyssey* (12.127–30), and mentions several modern instances. Others have substantiated this practice with archaeological and ethnographic evidence, as for example, in the work of Nick Kardulias, Timothy Gregory, and colleagues in the area of the Saronic Gulf. Their teams performed architectural and surface artifact surveys on a number of offshore islands and islets, and if those were occupied, they interviewed residents. On the small, waterless island of Evraionisos in the western Saronic Gulf (dimensions 1000 × 400 meters), they found evidence of many periods of use, most prominently LBA and Late Roman (Kardulias et al. 1995). The discovery of LH IIIB and IIIC artifacts, along with the foundations of fortification walls possibly of Mycenaean date, is consistent with widespread evidence of use of near-shore islands in the LBA (Hope Simpson 1981). The presence of cisterns, fortifications, and other durable

structures suggested to the researchers the exploitation of marginal niches during times of economic and demographic expansion (Kardulias et al. 1995: 17). The island, lacking water and arable land, could be used as a lookout and for grazing sheep and goats, but it could not long sustain occupation without a lifeline to the mainland. The success of productive activity on what amount to tiny rocks protruding from the sea depended on certain conditions of connectivity; specifically, the economic expansion of the Mycenaean palatial period made the exploitation of Evraionisos viable by enhancing connectivity and incorporating new nodes into an ever denser web – in this case at the level of the small world.

Ethnographic and ethnoarchaeological work directed by Kardulias on the island of Dokos off the coast of the southern Argolid examined the adaptations of modern herders (Kardulias 2000). These observations help to fill in the many gaps in our knowledge of the use of such islands in antiquity with plausible adaptation scenarios. Dokos, also waterless, is more strategically located than Evraionisos on a sealane between Cape Malea and Athens. Yet in a variety of ways, the inhabitants are equally dependent upon external connections for survival. In order to make optimal use of their scarce resources, they have adopted a mixed subsistence and settlement strategy. Kardulias learned that the 22 families living on Dokos in 1945 herded sheep and goats, grew wheat and olives, maintained domestic gardens, foraged for wild plants, and collected water in cisterns for human and animal use. Yet in spite of their risk-buffering behaviors and attempts at self-sufficiency, this economy could only function if articulated to the markets and resources of the larger island of Hydra and the mainland around Hermione. On Hydra they sold animals, cheese, and milk. In addition, many of the men worked away from Dokos for much of the year. Some were sponge divers in far-flung Aegean locations, others did wage work on Hydra, and still others rented pasture on the mainland for about half the year because grazing on Dokos was inadequate. The rent for these grazing rights was usually paid in kind with milk, cheese, and wool. Thus, even a "goat island" witnessed multifaceted economies (reminiscent of the "traditional" Mediterranean economy: Butzer 1996; Halstead 1987) closely linked to larger economic nodes and structures (Kardulias 2000: 38–39). Evraionisos and Dokos provide an intriguing glimpse at how the small parts of a maritime small world might have fit into the local-scale Bronze Age economy.

The practice of ferrying people across short expanses of sea (*porthmeutike*) is well attested in Greek literature and inscriptions; the routes between Attica and the Saronic islands and between the Greek mainland and Euboea seem to have been especially heavily traveled in classical times (Constantakopoulou 2007: 222–26). This sort of short-distance traffic must have been a ubiquitous feature and a fundamental mechanism of connectivity in a small world: a lifeline for inhabitants of offshore islands, and the means to maintain social ties among coastal communities. Interestingly, Kardulias' informant on Dokos used one of

his own boats to transport tourists to and from the various coastal towns and islands in the vicinity (Kardulias 2000: 42).

The island–peraia relationship that Constantakopoulou describes from literary and epigraphic sources for the Classical and Hellenistic Aegean involves a powerful island state possessing coastal lands on the mainland opposite; often these territories were quite large, but susceptible to expansion or contraction with shifting political fortunes. Such relationships could have existed in the Bronze Age, but it is important to note that Constantakopoulou's peraiai are explicitly *political* possessions, even if a primary motivation for holding one must often have been economic (e.g., control of mines or agricultural land). Certainly there were powerful island centers in the Bronze Age Aegean,[4] but control of any kind extending to the mainland, economic let alone political, is something to be demonstrated and not assumed. This question will be addressed in Chapter 7 with regard to Aigina's relationship with Saronic coastal settlements.

How and why, then, do small worlds cohere? My definition is intended to address that question. Connectivity and interaction explain *how*, but the question *why* is more complex and less amenable to resolution by archaeological means. Small worlds are not determined solely by environment or geography, although proximity is tautologically essential to their configuration. Despite the fundamental influence of environmental factors, small worlds are "culturally defined unities" (Broodbank 2000: 175) that result from conscious decisions to forge connections with nearby communities. In constructing his network analysis of EBA Cycladic interaction spheres, Broodbank (2000: 176–77) considered population growth, maritime travel ranges, and climatic variability with respect to resources as potential engines for the formation of local-scale interaction spheres, before deciding to emphasize the first of these. In Broodbank's model, population increase (simulating the rise in population from the Neolithic to the peak of complexity in EB II) altered the number, size, density, and location of small-world clusters in the Aegean; a similar outcome might be expected for an analysis tracking population rise on mainland Greece from the EH III–MH II demographic crash through the Mycenaean palatial period.

Renfrew (1993: 10–11) enumerated eleven social and economic motivations for travel to engage in various types of material- and nonmaterial-oriented interactions: to trade one's goods, to obtain others' goods, to participate in social gatherings, to seek knowledge or wisdom that will impart prestige, to visit a distant holy place as a pilgrim, to train or learn a skill, to find work or a better living situation, to serve as a mercenary, to find a spouse, to visit relatives or friends, and to serve as a sanctioned emissary. From this list we might extrapolate some more specific strategies that center on social ties that helped to bind communities into small worlds. The dispersal of kin or descent groups may originate in periods of low population density and limited mobility, when communities must look outward for intermarriage as a way to widen the gene

pool and ensure reproductive viability, and for economic accommodations to counteract resource variability or unforeseen shortfalls. Along with these relationships come various social obligations that might include periodic gatherings for feasts or other kinds of rituals promoting solidarity and group identity. The maintenance of kinship ties by means of inter-island voyaging has been the topic of detailed ethnographic studies, particularly in Oceania (e.g., Hage and Harary 1996; Hage and Marck 2002). We might also imagine economic interests born not of necessity but of desire: both within and beyond small worlds, we observe in the archaeological record a widespread preference for Melian obsidian over locally available chert for stone tool manufacture, or for Aiginetan cooking and storage pottery over locally manufactured functional equivalents.

We should also consider certain proximity effects. The phenomenology of lines of sight among island and mainland coasts created an everyday visual world that invited interaction and inhibited isolation. The rough geographic limits that I have suggested for small worlds distinguish them from larger spheres of interaction because they represent a range of routine travel without the need for specialized nautical and navigational technology (given the technology of the time). To emphasize the point that small worlds should be more stable over time than larger spheres of interaction, we can observe in the historical record that favorable economic and political conditions for cross-cultural, long-distance trade wax and wane: complex networks collapse, as the great eastern Mediterranean state system did circa 1200 BC; the seas may be infested with pirates, etc. Under any conditions, small worlds may lack the capacity to participate in larger interaction spheres. Thus, small worlds would be characterized by certain kinds of economic transactions involving face-to-face trading between producers and consumers, or small-scale redistribution from key coastal nodes. In Renfrew's framework, home-base reciprocity, boundary reciprocity, central-place redistribution, central-place market exchange, and localized down-the-line trade could all exist in a small world (see Fig. 2.5). Yet any small world could contain a major harbor – even a colonial enclave or port of trade – that articulated the local area to regional or interregional networks, bringing in other forms of interaction, including cabotage or directed emissary trade. In such cases, the different spheres of interaction blend, and it may not be possible to separate them, either conceptually or in the archaeological record. For example, the Pseira (Hadjidaki and Betancourt 2005–2006, 2006) and Point Iria (Phelps et al. 1999) shipwrecks are compatible with small-world connectivity. But we cannot be sure whether the Point Iria ship was Cypriot, having traveled a very long distance to Crete and then to the Argolid; a Cretan ship moving Cypriot goods with their own; or a local boat plying the Argolic Gulf with nonlocal transport vessels that had been recycled numerous times – and still other scenarios are possible. We can speak more confidently about short-haul trade regarding the Pseira ship. The spread of material at the wreck site, along with the utilitarian function and

local provenience of the MM IIB transport amphoras and hole-mouthed jars in fabrics of the Mirabello region (Hadjidaki and Betancourt 2005–2006: 84–85; P. P. Betancourt, personal communication, 2011), indicate a small ship operating in a small maritime world centered on the Gulf of Mirabello.

There are several models of local- or small-scale maritime networks in the ancient Aegean, but their logic and geographic scale do not necessarily match those presented here. As is the case for coastscapes, Horden and Purcell's microregions and "definite places" may be entirely terrestrial, and when they include coasts, they may also encompass several interior zones. The "mini island networks" of Constantakopoulou (2007: 176–227) are more in line with the scale and maritime focus of my small worlds; however, they are explicitly political clusters of islands and it is not clear how she would map economic networks for the Classical and Hellenistic Aegean. Sherratt and Sherratt (1998) include the term *small world* in the title of an oft-cited article, but the text has little to do with local-scale connectivity, and in fact the term itself is not repeated in the body of the article. If anything, the networks they describe are long-distance and cross-cultural. Similarly, Irad Malkin envisions Greek colonization of the eighth to sixth centuries " . . . turning the vast Mediterranean and the Black Sea into a 'small world'" (Malkin 2011: 5).[5] This radically more expansive definition follows closely the "small world networks" as imagined by social network analysts (Watts and Strogatz 1998). In social network theory, small-world networks emerge when the addition of a few key links joins smaller, neighboring clusters, creating paths and shortcuts to more distant clusters. The *network* proximity of these models need not equate to *physical* proximity (Leidwanger 2011: 89). To be sure, shortcuts and direct long-distance connections link small worlds (or coastscapes within small worlds) to regional and interregional networks, even by bypassing the members of the local small world altogether. When they do so, however, they are not operating in small-world spheres of interaction (as I understand them), either geographically or conceptually.

My small worlds find closer parallels with the "clusters" of social network analysis (Scott 1991: 129–33). Clusters are aggregates of points (or nodes) that form high-density areas in a network graph, and that separate from other clusters. Since not all points within such a cluster need be adjacent (e.g., the cluster can be elongated with many points intervening between end members; Scott 1991: 131, fig. 7.2:ii), this pattern of network proximity could be comparable to the geographic configuration of an elongated maritime small world with many coastscapes arrayed along its length. An entity that exists below the level of the cluster is the "neighborhood," which encompasses all the points to which a given point is *adjacent*, or connected directly by a single line or step. Thus, conceptually at least, clusters could correlate with my definition of small worlds and neighborhoods with fragments thereof consisting of neighboring coastscapes, but caution is warranted regarding the concept of distance. The

distance between two points in a network analysis is defined as the length of the shortest path connecting them, where the length of a path equals the number of lines and intervening points it takes to get from one point to the other. This may or may not approximate a realistic travel itinerary, but in any case it does not represent geographic distance and it does not address social or environmental friction to interaction.

Broodbank's small worlds seem to provide the closest fit. He repeatedly refers to small worlds as "local worlds" or "local interaction networks" (Broodbank 2000: 175–76), and by locating a number of small worlds *within* the Cyclades, adopts a geographical scale that is commensurate in magnitude with those I advocate, for example within the Saronic or Argolic Gulf. Many of his criteria for linking nodes into networks, mentioned above, are adopted in the chapter to follow when practicable. The most important criterion for his network analysis, population change, will be difficult to quantify for many periods in the absence of good cemetery data. Along similar lines, James Wright (2010) has proposed that social groups in the Bronze Age Aegean formed at scales he calls *local*, *locality*, and *regional*. For Wright, the local consists of a community and its territory, and the locality embraces several interlinked communities "among which interaction is so common as to regard them as extensions of each community" (Wright 2010: 806). In principle, local and locality correlate closely with my notions of coastscape and small world, respectively, although many of Wright's examples are drawn from internal valleys with primarily or exclusively overland interactions. In a more maritime context, Wright (2010: 808) wonders whether the island of Aigina was a single locality or rather consisted of multiple localities in the MBA. This is a question that searches beyond the coastscape to explore the internal relations of an island, analogous with examining the connections of coastal settlements with interior hinterlands. Although this is not the primary focus of the present study, fleshing out these relationships will indeed be a crucial part of the analysis of coastscapes and small worlds.

Lastly, there is the question of whether the earliest Greek literature – Homer or Hesiod – might illuminate the maritime small world. For instance, do the contingents of towns mustering ships in the Catalogue of Ships in *Iliad* Book 2 make up something like small worlds? Many contingents are composed primarily of men from inland locations, but if we consider the maritime regions of the northeastern Peloponnese, the organization of the realms is curious from the point of view of both network logic and archaeological evidence. Agamemnon's fleet draws men from a vast hinterland stretching north, encompassing the northern Corinthia, and west to the truly distant Achaian towns of Helike and Aigion. Such a realm makes little economic or political sense, given the difficulty of connectivity and the sheer distances over this rugged terrain. Moreover, there is little archaeological evidence to support a direct presence from Mycenae in the northern Corinthia and Achaia, but instead a great interest in the Argolic

and Saronic Gulf regions (Pullen and Tartaron 2007; Tartaron 2010), which in the *Iliad* are controlled by other men. The Saronic Gulf itself is carved into three separate contingents: one from Athens, one from Salamis, and Diomedes' contingent of nine towns on the Saronic and Argolic Gulfs. A political division along these lines could conceivably exist, though nothing like it is known from the Bronze or Early Iron Age. It certainly does not map well onto the logic of the maritime small world in social or economic terms.

Hesiod's adventures in sea trade and his crossing from the Greek mainland to Euboea (*Works and Days* 619–94) are more credible, reflecting the kinds of interactions one would expect within a small world. The part-time maritime pursuits of the farmer in early Greece, operating as a local-scale merchant of his produce, exemplify the nonspecialist nature of much seafaring in a small-world context. Hesiod's crossing to Euboea to perform at funeral games was likely made on one of many ferries engaged in the kind of *porthmeutike* routes mentioned above. Despite the omnipresence of the gods in the *Works and Days*, Hesiod paints a realistic and unflinching portrait of agricultural life and the pragmatics of local politics, one which inspires more confidence in its utility for illuminating small-world activities.

Regional/Intracultural Maritime Interaction Sphere

New problems are encountered when trying to discern the transition from the local context to something larger, a medium scale that we might call *regional*, and then again from the regional to the interregional or international. It has always been tricky to define the medium-scale region, since one could use many criteria: geographical or environmental regions delimited by transitions from one climatic regime to another, or from one gulf, basin, or other oceanographic feature to another; economic regions based on the extent and intensity of trade relations; social regions based on the distribution of language or cultural traits such as architecture or religious practices; political regions based on territory controlled by a state; or some combination of these. For prehistoric periods, the absence of texts (or near absence, in the Mycenaean case) forces reliance on reading from the surviving archaeological remains the unifying factors that make up a region.

A crucial distinction must be made at this juncture. By *region*, I am referring to *maritime* regions and the scale at which connectivity at sea – measured by technology, travel times, social relations, and other environmental and human factors – permits extralocal interaction spheres to cohere at any given moment. This is very different from terrestrial regions, where a different set of topographic and cultural constraints causes territories to coalesce or fragment into what we call "regions." We should not expect them to map onto one another very closely. For the Mycenaean world, I prefer to define medium-scale *regional*

maritime interaction as (1) occurring in a geographical space beyond the small world, and thus outside the realm of habitual, face-to-face interaction; but (2) still characterized by participation in a recognizably Mycenaean material culture and, to the extent that we can know, common customs and beliefs; and (3) occurring less frequently than interactions in the small world, but considerably more often than those involving long-distance, cross-cultural relations. This definition necessitates speaking of a Mycenaean "culture area." Such an area was neither static nor delimited by hard boundaries; nor was it continuous in space. Attempts have been made to draw lines around a map of the Mycenaean world, sometimes distinguishing between a "core area" and a "periphery" (and more recently, "semi-periphery" and "margin"; Feuer 1983, 1999; Kardulias 1996, 1999; Kilian 1990; Parkinson and Galaty 2009a; Sherratt and Sherratt 1998). Questions arise about the outer limits of a Mycenaean culture area: Was a maritime voyage from Mycenae to Knossos on Crete in LH/LM III an intracultural or cross-cultural journey? The answer depends on how pervasive one believes the Mycenaean presence was on Crete at the time, and on that point there is vigorous disagreement (Burke 2005; various articles in Driessen and Farnoux 1997; Preston 1999, 2004). In a similar vein, would the Mycenaean (or is it Mycenaeanized?) settlement at coastal Dimini in Thessaly (Adrimi-Sismani 2007; Pantou 2010) be considered part of the Mycenaean cultural sphere? Probably so, but what about sites like Assiros or Toumba Thessalonikis in Macedonia (Andreou and Kotsakis 1999; Buxeda i Garrigós et al. 2003; Wardle 1980), where contact with the Mycenaean world is apparent in pottery styles and decorations, which exist however in thriving local, non-Mycenaean, settlements? Probably not, but what factors determine inclusion or exclusion?

For the purposes of the present analysis, and from the perspective of a sea traveler, I suggest that intracultural interaction should include those places where a ship's captain could expect to find a substantial population of people speaking Greek and observing recognizable customs, such as ritual, funerary, and domestic practices. Other conformities with material culture, such as town planning and architectural design or pottery forms and decorations, were more variable and might not have been so central to Mycenaean identity. Roughly, this "Mycenaean maritime culture region" would encompass the Aegean Islands and the Aegean coasts of the Greek mainland as far north as the Bay of Volos; Crete from LM IIIA if not earlier; and the coasts and islands of the Ionian Sea as far north as the Ambracian Gulf, but would exclude much of the Aegean coast of Asia Minor north of Cape Mykale (Fig. 6.1). A regional, intracultural sphere of maritime interaction defined in this way is of course open to numerous objections. There are many areas within it, both coastal and inland, that by any definition were only tenuously Mycenaean; conversely, there are a few plausible Mycenaean coastal colonies and points of frequent contact beyond these areas, such as at Glykys Limin on the southern coast of Epirus (Tartaron 2004: 145–77),

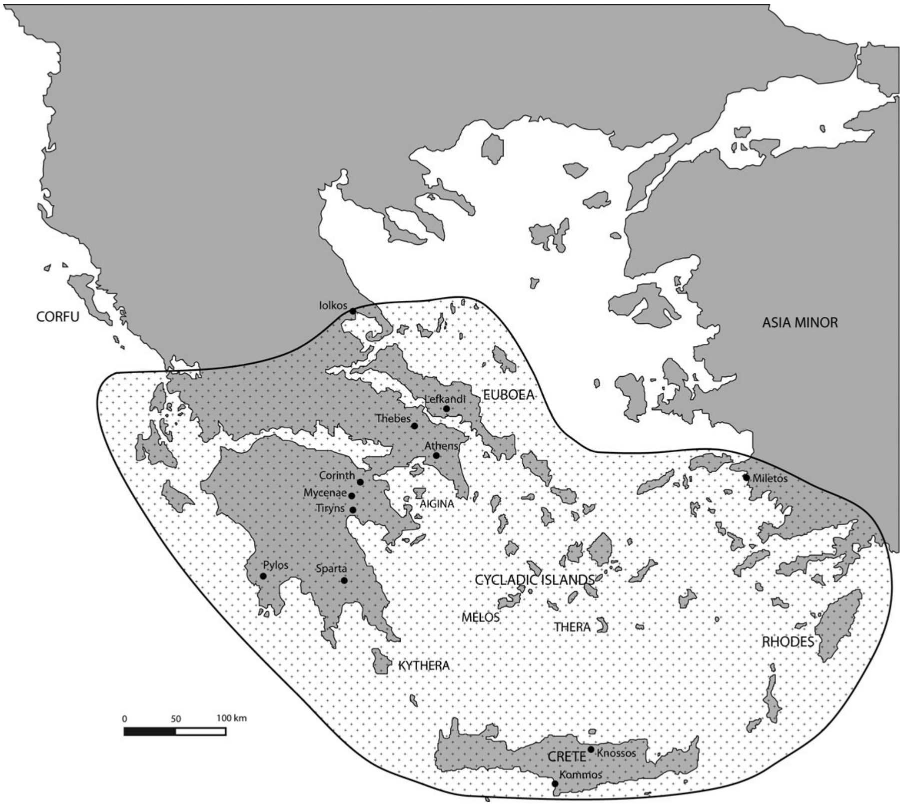
and in southern Italy and Sicily (but see Blake 2008 for a strong challenge to the notion of Mycenaean colonies there). Nonetheless, keeping in mind the fuzzy, shifting, and discontinuous nature of the Mycenaean cultural sphere over the course of the LBA (Tartaron 2005, 2010), it should be possible to carve out hypothetical regional interaction spheres within the confines of this map.

The entire area in question is not large, and a sailing vessel should have been able to traverse most of it within several days or less. But once a ship and its crew broke free of the confines of the small world, the nature of seafaring changed, with different actors and different agendas. We can now assume the presence of specialist seafarers, members of the kind of maritime community described in Chapter 4, who possessed specialized knowledge of navigation and of the natural and social conditions existing at distant places. Their ships would now have to be open-seaworthy, and perhaps more purpose designed to optimize for hauling cargo or transporting personnel over longer distances. Because of the topography of the Aegean archipelago, extended trips could be made by coast- and island-hopping, minimizing the need for frequent open-sea or night sailing.

At regional scales, different modes of trade become prominent, including down-the-line and freelance (cabotage) trade as sailors move beyond the realm of habitual contacts to a world inhabited by comprehensible, yet increasingly unfamiliar, people and places. This aspect of the regional is similarly evoked by Wright (2010: 806): ". . . contact and travel among these localities is regarded as a departure from the safe and familiar."

Regional spheres of interaction are best measured by material culture studies that define the distribution of chronologically and culturally sensitive artifacts, features, and practices. Traditional methods of stylistic and formal analysis of pottery, stone tools, weapons, jewelry, seals and sealings, wall paintings, and other objects can be combined with archaeometric analyses to trace the movements of goods and illuminate the social dimensions of production, distribution, and consumption. This kind of synergy is illustrated, for instance, by the way that Penelope Mountjoy's stylistic study of regional variation in Mycenaean painted pottery (Mountjoy 1999) is informed by the results of chemical and petrographic analyses undertaken over several decades, most recently by the Bonn group (Hein et al. 2002; Mommsen et al. 2002).

The archaeological record points to a material culture koiné gradually enveloping most of the Mycenaean core area in the palatial period. This trend culminates in the mature stages of LH IIIA, continues into LH IIIB, but diminishes in the second half of the thirteenth century in LH IIIB2. Goods and information flowed relatively freely within the Mycenaean world. Imports were common, but style and technology were also transmitted, as attested by local imitations of widely disseminated artifact types. Petrographic analysis has demonstrated that pottery shapes and decorative styles were often imitated, using not only local materials, but also fabric recipes and manufacturing techniques



6.1 Map of a hypothetical Mycenaean maritime culture region.

specific to local potting communities. For example, during MH the spread of fine gray burnished ware across central Greece, the Corinthian Gulf, and the western Peloponnese, or the distribution of lustrous decorated ware that links Kythera, Laconia, and the Argolid, can be said to mark out intracultural regions of economic interaction (Wright 2010: 809–10).

Only a few mentions of intra-Aegean trade exist in the Linear B tablets: most notably, Mycenae Tablet X508 records the transfer of a type of cloth to Thebes (Bennet 2008: 201–202), and exchanges between Thebes and the apparently subordinate towns of Karystos and Amarynthos on the island of Euboea involve the movement of wool to Euboea and pigs, goats, sheep, and cattle to Thebes (Chadwick 1994: 99; McInerney 2010: 64; Palaima 2004: 106). These latter interactions parallel Hesiod's short journeys from Boeotia to Euboea, and seemingly reflect the geographical extent of the Theban state and possibly a microregion of the scope described by Horden and Purcell. Various explanations have been advanced for the scarcity of references to intra-Aegean exchange, which patently contradicts the archaeological record. In view of the thousands of extant tablets that document other aspects of the economy in considerable detail, we can rule out accidents of preservation; and given the archaeological

evidence it is difficult to argue that the interactions were simply infrequent. The most plausible explanations center on the palaces' administrative practices: if these exchanges were seasonal or irregular, they may have occurred outside the limited time frame of the administrative cycle preserved by the destructions, or they may have belonged to a different, perhaps higher, administrative level not recorded on clay tablets (Bennet 2008: 202). It is also possible to suggest that most such connections had been interrupted by social disturbances in the months and years leading up the collapse of the palaces. Nevertheless, the homogeneity of the Linear B script, the language it represents, and the administrative system it served at the palaces indicate a significant level of intracultural interaction, at least at the elite level, which complements the archaeological evidence for the interconnectedness of the Mycenaean polities.

Interregional/Intercultural Maritime Interaction Sphere

Continuing the logic of the expanding geographical and cultural scope, the interregional/intercultural maritime interaction sphere involves interactions and networks that extend beyond the Mycenaean maritime culture area. As outlined in Chapter 2, Mycenaean extra-Aegean connections are often deduced by plotting the distribution of Mycenaean objects found beyond the Aegean and the non-Aegean objects found in Mycenaean contexts (Burns 2010: 36–40; Cline 1994; Lambrou-Phillipson 1990; van Wijngaarden 2002). The historical sketch and the discussion of the problems of interpreting the very partial evidence presented there need not be repeated, but a few key points might be emphasized (see Table 6.1).

We do not know how often, how far, or from where, Mycenaean ships might have ventured beyond familiar waters. Sporadic visits of Mycenaeans to far-flung lands beyond the Aegean seem assured for Cyprus and the northern Levantine coast in the East, as well as the shores of southern Italy and Sicily in the West. The catalogue of imported objects, which we might have expected to travel home with Mycenaean merchants, is neither impressive quantitatively nor widely distributed geographically, however. A dominant role for ships operated by intermediaries based at Cypriot or Syro-Canaanite entrepôts (represented by the Uluburun and Gelidonya wrecks) in maintaining long-distance networks cannot be discounted. It is likely that a series of intermediate nodes was interposed between the East and the Mycenaean heartland, with down-the-line and freelance trading the rule and direct voyages or diplomatic missions the exception. Around the rim of the Aegean, Crete, with its long history of engagement with the East, and Miletos or Rhodes, enjoying proximity and close contact with the Hittites, were well positioned as ports of call and transshipment points. Whether ships were controlled by palaces or independent merchants, there was ample opportunity to mix private enterprise with official

business. Long-distance voyaging was the realm of seagoing ships manned by master navigators and seasoned sailors with knowledge of open-sea sailing and experience with sea lanes and hazards en route to distant places. Traversing intercultural space, these ships entered ultimately into the realms of intracultural regions and small worlds, instantiating the intersection and overlap of the nested scales of interaction described in this chapter. Once inside a small world, the *xenoi* relied on their accumulated knowledge and the accommodation offered by locals for safe landfall at one or more anchorages. This would also have been the case for ships traveling long distances within the Aegean world, as when a ship from the Argolic Gulf made landfall in a Cretan small world at the Gulf of Mirabello. The case for Mycenaean permanent presence in enclaves or colonies beyond Aegean and Ionian shorelines is equivocal at best and dubious at worst.

In closing this section, it needs to be stressed that geographically defined spheres of interaction are always contingent to time and place. I have chosen to define four maritime interaction spheres based on geographical scale, frequency of interaction, and cultural identity. They are meant to fit what we know about the political organization and maritime technology of the LBA, as well as the moderate distances and dense distribution of islands that characterize the Aegean region. It would make little sense to apply these spheres without modification to the widely dispersed islands of Oceania, or to the enormously different conditions of political organization and maritime technology of Greece during the Roman period. Even in the Bronze Age, we can observe coastscapes emerge, thrive, decline, and disappear; small worlds alternate between cohesion and fragmentation; and long-distance connectivity of Aegean polities with the eastern and central Mediterranean fluctuate over time with the political and economic conditions of the day. For this reason, our frameworks must be flexible enough to accommodate a diachronic history of adjustment and reconfiguration. In the following chapter, I will attempt to show how such histories can be written within the maritime cultural landscape framework.

Connectivity and Social Network Theory

Following Fernand Braudel (1972), a central theme of Horden and Purcell's *The Corrupting Sea* is that the extreme fragmentation of Mediterranean coastlands and islands encourages intensive local interactions by sea, while relatively easy maritime communication allows these to be expanded to form larger networks as environmental, economic, and political conditions permit. The emphasis on microregions as the fundamental building block for networks of all sizes is no accident: "The short hops and unpredictable experiences of *cabotage* are . . . the basic modality for all movements of goods and peoples in the Mediterranean before the age of steam" (Horden and Purcell 2000: 365). Malkin et al. (2007: 1) describe the symbiosis of two tiny, neighboring Aegean islands, Herakleia and

Schinoussa. Herakleia's harbor is protected from the southeast, Schinoussa's from the northwest. As winds and weather change, fishermen and yachtsmen rush to move their boats from one island to the other – a relatively common occurrence that illustrates another element of Horden and Purcell's paradigm, the instability and unpredictability of the Mediterranean climate. The coastal world (or "mental horizon") of these islanders consists first of their village; second of their linked harbors; and third of the Aegean and Mediterranean beyond. This conceptualization of the maritime world conforms well to the coastscapes, small worlds, and larger spheres of interaction proposed in this chapter. Malkin and colleagues (2007: 1) call the relationship between Herakleia and Schinoussa a "fractal" of Mediterranean networks: operating at a small, local scale, but exhibiting dynamics that can extend to the whole of the Mediterranean. This analogy from the natural world is an intriguing one, but debatable – is the architecture of a local maritime network repeatable and remarkably similar at any scale? Because of the quantum leap in knowledge and professionalism, as well as the different kinds of exchanges that characterize the transition from small worlds to larger spheres of interaction, I am skeptical that this should be so.

Yet these scholars rightly question the notion that autarchy or true isolation existed in the Aegean, insisting instead that microregions and microecologies, while distinctive, cannot be separated from the wider networks of which they form a part. Balanced against the certainty that in aggregate, small-scale interaction moved far more goods and people than did long-haul traffic, as well as the likelihood that rather few Bronze Age coastal dwellers ever ventured far from home, must be the realization that the ways that microregions interact and form clusters (i.e., connectivity) are as important as their internal features. As Horden and Purcell (2000: 465) put it, "The wider historical context is as potent a factor in the workings of the microecology as is the local physical environment or the human responses to it." Still, I would defend the separation (however fuzzy) of the different scales of interaction for analytical purposes, in agreement with Michael Galaty and colleagues (Galaty, Parkinson et al. 2009: 43), who caution that they possess contrasting dynamics that cannot be revealed when conflated.

The ways that connectivity works highlight both the corporate responses of (to us, faceless) societies to opportunities and constraints of the physical and social environment, and the decisions and actions of intrepid individuals and small groups. Horden and Purcell's (2000) "four definite places" and the hundreds of other examples they offer to illustrate historical connectivity draw attention to the insights that emerge from written documents and the limits of our knowledge in the absence of them. They offer a kind of template for the establishment of maritime relations that accords agency to individual coastal settlements and their inhabitants: two ports, located a short voyage apart, have goods to exchange and people whose mutual interests and understanding of each

other promote friendly relations. They make a pact to encourage exchange, and set about improving their port facilities.[6] Local agency is a common feature of social networks, which are often understood as self-organizing systems " . . . due to the local decisions made by the individual vertices" (Barabási and Albert 1999: 512). Once established, such relations can become durable, carrying on in spite of the vagaries of environment, politics, and economics in the wider world, and even if the rationality and expediency of the connection itself is lost (Horden and Purcell 2000: 128). A reason for this may be the deep social ties that have developed over time. In periods of growth, the information, resources, services, and people flowing along these paths stimulate the creation of new vertices and paths, resulting in clusters that coalesce at larger and larger scales; thus, the formation of world systems from microregions.

Network Models and the Aegean Bronze Age

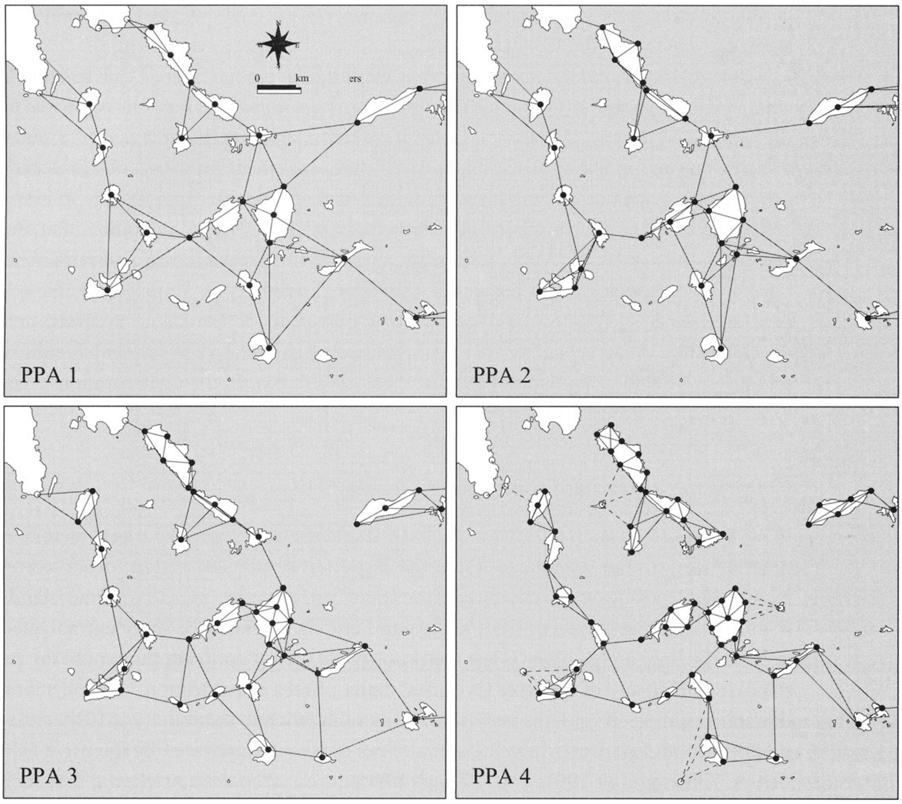
Two important attempts have been made at spatial modeling of maritime networks in the Aegean Bronze Age: Broodbank's (2000) for the Cycladic Islands in the EBA, and that of Knappett and colleagues (2008) more broadly for the Aegean, with a focus on the MBA. Network analysis has not been explicitly applied to the Mycenaean period.

Broodbank's network model consists of a Proximal Point Analysis (PPA) that simulates interaction networks given certain assumptions about the number and location of interacting nodes (in this case, settlements).[7] PPA predicts patterns of connections between points distributed in space, conventionally by connecting each point with the three closest to it. The webs formed by these connections generate network clusters, as some points accumulate more links by virtue of their proximity to a larger number of other points. The denser clusters hypothetically mark out interaction "centers" where communication ought to flow most easily. The actual placement of points in the model is a problem given the fragmentary nature of the archaeological record. Broodbank addresses this by placing known sites on the map and then proceeding to add points to simulate the growth of population over time. The number and location of these points is determined by varying the amount of land area required to place a point on an island. He creates four different models (PPA 1–4) by adding a point for every 150, 100, 75, and 50 square kilometers, respectively (Fig. 6.2), and then compares the results to the apparent settlement patterns of the Neolithic to EBA Cyclades. PPA 1, with only 19 points, is taken to resemble the Neolithic–EB I pattern of low-density networks in which larger settlements and longer-distance connections are vital for survival. By contrast, the more heavily populated and highly connected EB II is simulated best by PPA 4, in which 54 points yield more localized, high-density networks and maximal small-island participation.

Broodbank's PPA is, like any other model, laden with assumptions, simplifications, and choices that affect its utility in representing reality (Knappett et al. 2008: 1010). In this case, it is assumed that communities interact most intensely with their nearest neighbors, since longer journeys are riskier and more time consuming. Sea travel is taken to be uniform in all directions. Sites are deemed to be of roughly equal size and distributed evenly in space among the islands. The links between them are similarly undifferentiated: one node can connect with any other directly or through a series of short hops as constrained by the available propulsion technologies of rowing and paddling. The only variables that can be adjusted to induce change are the number of sites in the system or the number of links each site can form. While this set of rules and assumptions obviously oversimplifies and distorts the reality of these networks, it is important to recognize that Broodbank's PPA was designed for the limited geographical world of the Cyclades and for a time in which boats were propelled by human power. Settlements were smaller and less hierarchically organized than in the later Minoan and Mycenaean palatial worlds. Within these bounded circumstances, the model can claim some success in explaining the presence or absence of certain centers around the Cyclades. For example, no such center is known on the large island of Andros, which in spite of possessing fresh water and arable land, is shown to be out of the mainstream of near-neighbor connectivity; conversely the settlement of Daskaleio-Kavos flourished on tiny, resource-poor Keros in the Erimonisia group by virtue of its position in a dense web of crisscrossing links. The fit, in terms of prominence or insignificance of sites, between the model and the archaeological record is not perfect, but Broodbank's analysis does demonstrate that network centrality was an important factor in the role that specific settlements played in maritime connectivity and in the way that clusters of small worlds were constructed. Yet PPA is limited in its application – it is not likely to simulate eras with large travel ranges well, or translate easily to greater geographical scales.

Knappett et al. (2008) sought to build on Broodbank's beginnings to devise a more sophisticated network model with wider applicability. Their model, which they characterize as "imperfect optimisation," uses a detailed mathematical equation to express the notion that participants in a network tend to strike a reasonable, though never perfectly optimal, balance between the costs and benefits of maintaining maritime connections. The model is far more flexible because it incorporates more of the variables that influence connectivity and allows the weight of each variable to be modified, either experimentally or to reflect current understandings of the archaeological record.

To assess the likelihood of connection between two sites, or the connective potential of any single site in a network, each site is coded with several variables, including a kind of estimate of importance based on site size, population, and available resources. Where the connectivity between any two sites is concerned,



6.2 Broodbank's PPA versions 1–4, based on different initial and growth conditions. Broodbank 2000: 184, fig. 53. Courtesy of Cambridge University Press.

the energy required to maintain contacts is a combination of the physical distance between them and the fraction of effort each devotes to the interaction. These values lead to an equation:

$$H = -\kappa R - \lambda E + jP + \mu T,$$

where H yields a quantitative representation of the energy balance between the costs of supporting the local population (P) versus the costs of maintaining links (T), and the benefits of exploiting local resources (R) versus the benefits of maintaining links (E). The characters κ, λ, j, and μ are constants that record the relative importance or weight accorded to each factor. The flexibility of this model resides in accommodating a broader number of variables that can influence connectivity, as well as the ability to alter variables as population, settlement patterns, or technologies (e.g., seafaring or mining) evolve. At the same time, the ratios of the constants can be modified to reflect different cost–benefit relationships between local affairs and nonlocal interaction.

Even with this more sophisticated and encompassing approach, Knappett's model carries its own assumptions and simplifications. A central assumption is

the network centrality of large sites, like Knossos, which are more connected than smaller sites and attract new connections preferentially because of their greater ability to acquire and control the resources needed to sustain and benefit from overseas contacts. Further, large communities tend to target each other, creating longer-distance connections and network hierarchies. This "gravitational pull" can aid in linking distant settlements and holding large-scale networks together. The disproportionate role of well-positioned nodes finds strong support in network theory. Albert-László Barabási and Réka Albert (1999) describe two common properties of networks: continuous *growth* by the addition of new vertices (i.e., nodes or points), and *preferential attachment* by which new vertices attach disproportionately to sites that are already well connected. These patterns can be observed in many kinds of social networks, such as the linking of documents in the World Wide Web or the preferential citation of certain articles in scientific literature (Barabási and Albert 1999: 510). These dynamics have several implications for Aegean Bronze Age maritime networks. One is that a node that acquires more connections than another one will accumulate them at an increasing rate, causing the difference in connectivity between the two to multiply as the network grows (Barabási and Albert 1999: 511). Such conditions may help explain the emergence of Mycenae during the Shaft Grave Era, with its wide access to exotic goods, or the rise of Knossos to an unparalleled position on Crete. Furthermore, the rapid growth in disparity between well- and less well-connected sites may result in the kind of explosive growth to prominence that seems to describe Mycenae in the Shaft Grave Era.

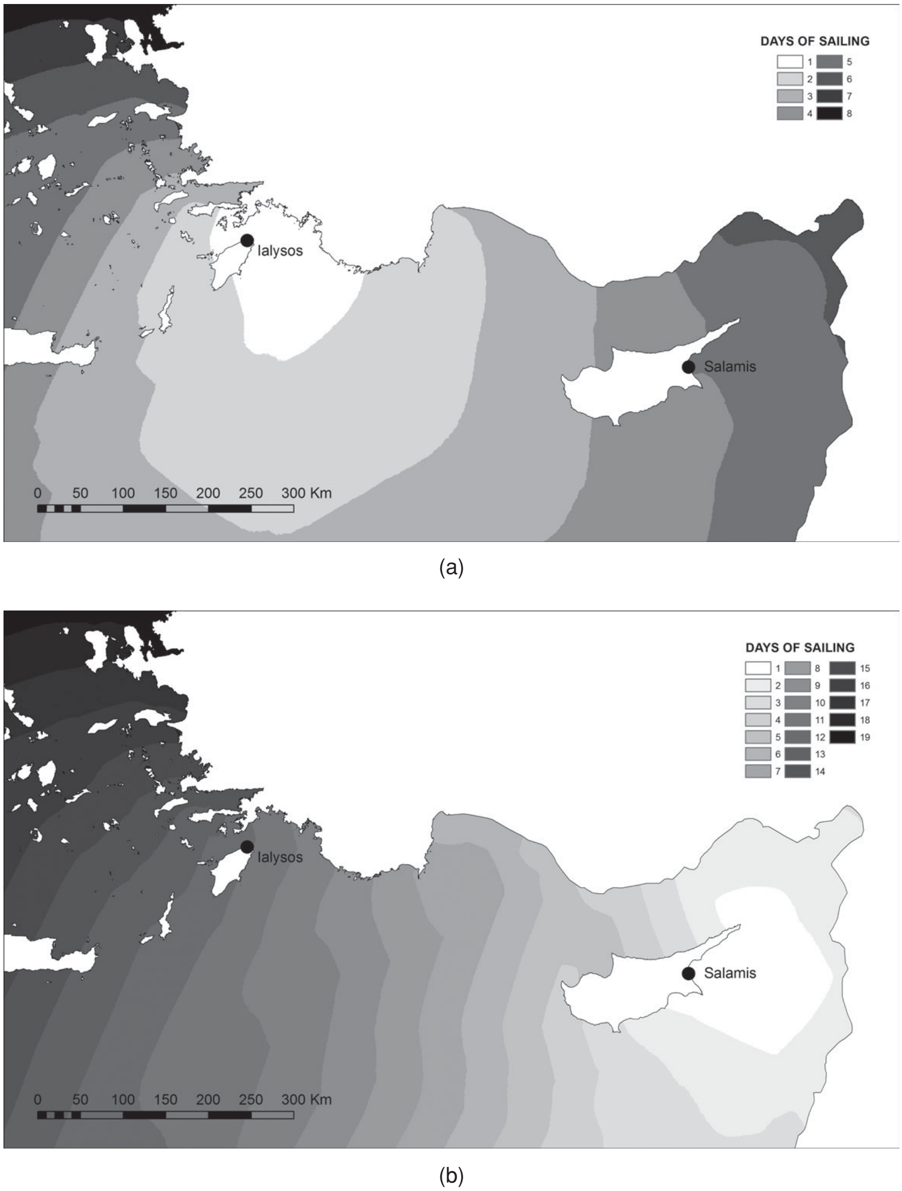
With the advance of seafaring technology and the emergence of large centers in protopalatial Crete, conditions were set for Aegean-scale networks to grow, requiring a model of greater scope and variability than Broodbank's PPA. Knappett and colleagues published a few variations on the imperfect optimisation model, including one in which the benefits of trade were incrementally increased ($\lambda = 1.0$, 2.0, 3.0, and 4.0: Knappett et al. 2008: 1015–1016, fig. 4). At each increment, the links between geographically distant areas of the Aegean – the mainland, Cycladic Islands, Crete, the Dodecanese and Asia Minor – strengthened and particularly well-positioned sites such as Akrotiri on Thera became crucial "intermediate" nodes in holding the larger network together, in spite of their modest size. Removing these nodes, as when Thera was destroyed in a volcanic cataclysm in the middle second millennium BC, can (and did) cause major disruptions in the broader network (Knappett et al. 2011).

When a PPA analysis was performed on the same data set according to Broodbank's rules, however, Crete failed to link to the Cyclades, and the Dodecanese Islands were entirely isolated from all other Aegean networks (Knappett et al. 2008: 1019, fig. 7). This is hardly surprising as it is difficult to generate large-scale networks when a node can only connect to its three nearest neighbors. Social network theory[8] predicts the constant addition of new vertices and the

creation of shortcuts between well-connected nodes, linking local clusters into "small worlds" (Watts and Strogatz 1998) and further to large-scale networks that may feature direct connections between powerful centers, or emporia that attract connections from the entire sailing universe.

Knappett's model can be manipulated to simulate admirably enough the kinds of networks that plausibly existed in the MBA Aegean, but it too has limitations, mainly the ambiguity of the quantitative value of the variables and constants that the mathematical equations use. How exactly, we might ask, are numerical values calculated for abstract concepts or data fields for which there is only fragmentary information? A few examples will illustrate this problem. The means of quantifying the "fraction of effort" that one site puts into its relationship with another is not explained; it seems perhaps to be equated with the fraction of trade, but how this is derived is unknown (Knappett et al. 2008: 1014, fig. 2). Part of the effort of maintaining the connection involved the ease or difficulty of intersite travel, but in this model distance and travel remain simplistic. While Knappett and colleagues recognize the need to arrive at travel times ("daily transport distance") rather than simple linear distances, the model does not incorporate any calibrations and we are left with a uniform, essentially friction-free sea. In a dissertation on Roman maritime trade in the eastern Mediterranean, Leidwanger (2011: 90–121) takes initial steps toward a textured seascape by constructing a GIS model using wind speed and directional data, as well as historical sources and sea-trial data from the replica ship *Kyrenia II*, to arrive at a friction factor, which is finally converted into a buffered map of sailing days from a given location. These maps of "cost weighted path distance" can be used to estimate the differences in travel for outbound and return voyages. For instance, applying the friction factor, the sailing time from Ialysos on Rhodes in the southeastern Aegean to Salamis on eastern Cyprus should be around four days, whereas the voyage in the other direction could take more than eleven (Leidwanger 2011: figs. 2.7, 2.10; Fig. 6.3). This kind of information would be valuable as an input for Knappett's distance and effort variables. Even these advances leave room for development, since one could envision friction factors incorporating currents as well as a stochastic element for storms and other hazards.

Other ambiguities arise as an inescapable result of the fragmentary nature of the archaeological record. Population (let alone population density) and carrying capacity figures are simply not available for most LBA settlements, at least not without wide margins of error. Lacking reliable quantitative data for these and other categories, calculations of site importance or cost–benefit for local and long-distance interaction are necessarily open to challenge. It is the double quandary of acquiring robust numerical values for structural features and then translating them through mathematical equations into social behavior that has led many historians and archaeologists to adopt a cautious attitude



6.3 Maps of cost-weighted path distance for eastbound and westbound journeys in the eastern Mediterranean. (a) Sailing days from Ialysos, Rhodes; (b) Sailing days from Salamis, Cyprus. Courtesy of Justin Leidwanger.

(Malkin et al. 2007: 6). One could continue the discussion along these lines, but it is sufficient to conclude at this point that social network analyses hold promise, as yet not realized. With further development and robust data, they have the potential to reconstruct maritime social and economic networks for prehistory, and to identify the dominant engines driving their formation and change over time. The purpose of the present critique is not to advance a skeptical position,

or to deliver a new, improved network model. Instead, I wish to expose the potential pitfalls of working with quantitative models that, if not invested with robust empirical data, give results that may seem authoritative but are in fact illusory. These are concerns of which Broodbank and Knappett were quite aware; hence their cautionary statements. I also want to alert readers that in the case studies to follow in the next chapter, data are often not amenable to quantification. In such cases, I follow Malkin and colleagues in adopting more qualitative characterizations of the maritime networks that I seek to analyze.

SEVEN

COASTSCAPES AND SMALL WORLDS OF THE AEGEAN BRONZE AGE

CASE STUDIES

The purpose of this chapter is to bring together the various conceptual and empirical approaches outlined in previous chapters in order to apply them to real-world times and places of the Aegean Bronze Age. In three case studies, this chapter suggests how we might write diachronic histories of maritime connectivity at local to regional scales of interaction. One lengthy case study is drawn from the "heartland" of the Mycenaean world in the Saronic Gulf, followed by two brief portrayals of potential coastscapes and small worlds, one focused on Miletos on the coast of southwestern Asia Minor, and the other on Dimini and neighboring sites on the Bay of Volos, which are meant to suggest opportunities for further research along the lines advocated in this book.

This exercise aims to reveal the trajectories over time of coastscapes that may range from isolated to highly connected, and of small worlds that oscillate between cohesion and fragmentation, which often means alternating between hierarchical and heterarchical or nonhierarchical organizational structures. It focuses both on internal dynamics and on the ways that external stimuli – opportunities, threats, and greater historical currents – impinge to play often profound roles in local and small-regional histories. Placing a primary emphasis on coastscapes and small worlds means eliciting rich local contexts from which to build out to broader spheres of interaction (Galaty, Parkinson et al. 2009; Tartaron 2010; Wright 2010: 808, 815). These case studies construct histories *in* the Mediterranean, because only when these are robust can they offer comparative material to the grand project of history *of* the Mediterranean (Horden and Purcell 2000).

Making and Breaking a Small World: The Saronic Gulf, 3000–1200 BC

The essential aim of this case study is a diachronic reconstruction of a Bronze Age maritime small world in the Saronic Gulf. The inhabitants of Kolonna on the island of Aigina dominated this small world of many coastscapes – coastal settlements dotting the islands and mainland – from the middle of the EBA until the early phases of the LBA, when the expanding palace at Mycenae broke it apart, incorporating Saronic communities into broader Aegean networks. Over its life, this small world alternated between cohesion and fragmentation, as Kolonna responded to conditions within the Gulf and without, often initiated by events taking place beyond the Saronic and affecting large parts of the Aegean. I will attempt to write this history primarily from two vantage points: from the center at Kolonna; and from the small Bronze Age settlement at Kalamianos, built upon a gently inclined shoreline near Korphos on the Saronic's western coast. Kalamianos was a rather minor player for most of the period under consideration, only achieving prominence in EH II and LH IIIB. Other settlements in Kolonna's orbit will be called upon to fill in aspects of the story.

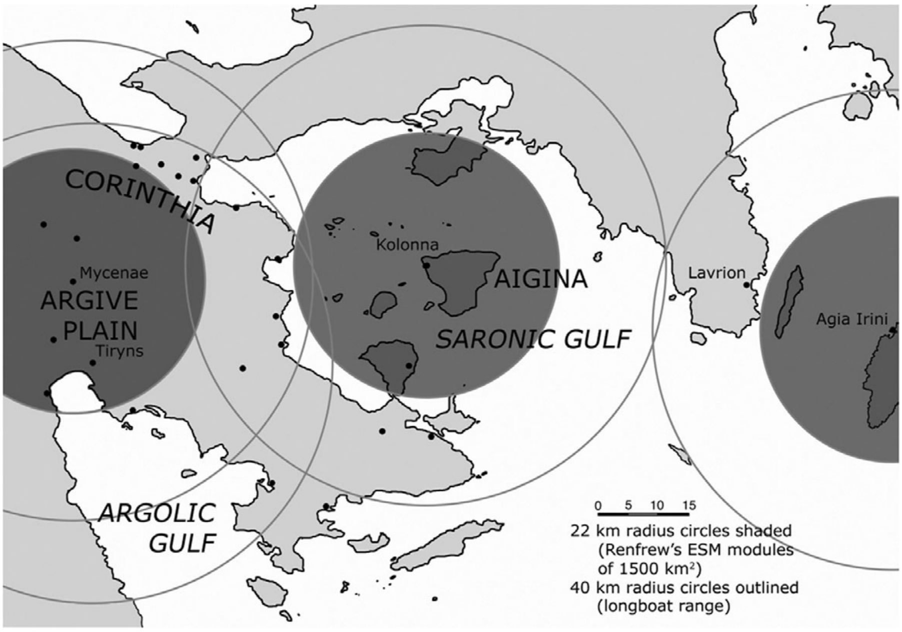
The Physical Environment of the Saronic Gulf

The Saronic Gulf occupies a central place in Greek maritime history, in part because of favorable sailing conditions and a strategic geographical situation (Fig. 7.1). It is partially enclosed by the land masses of the Argolid, the Corinthia, and Attica; as a consequence, winds, waves, and currents are moderate compared with more open areas of the Aegean Sea (Heikell 2002: 17, 29; Soukissian et al. 2002). The winds are reasonably consistent, especially in the summer months. The meltemi blows from the north to northeast, beginning fitfully in July and increasing to full strength in August to early September before diminishing thereafter. It generally blows in the Beaufort 3–5 range (gentle breeze to fresh breeze), though in peak season it reaches 5–6 (fresh breeze to strong breeze) and occasionally higher. Winter winds are less consistent and winds up to gale force are more frequent, though hardly common. Waves are rarely significant enough to be damaging to coastal areas or dangerous to maritime traffic, and there is a minimal effect from the currents of the Black Sea Waters, mainly in the form of some strong anticyclonic eddies at the mouth of the Gulf (Olson et al. 2007). These currents, combined with meltemi winds, can make for a bumpy ride departing the Saronic for the Cyclades (Heikell 2002: 29, 52). Isolated storms with associated squalls may arise at any time of year, though they are not common in the warmer months and they seldom last for more than an hour or two. The Saronic has relatively few dangerous reefs and rocks, excepting those quite close to shore and those in the narrows between small islands or between

7.1 Map of the Saronic Gulf region with important Bronze Age sites indicated. Pullen and Tartaron 2007: 147, fig. 14.1. Courtesy of the Cotsen Institute Press.

islands and offshore islets. While these mean characteristics establish the Saronic as an inviting maritime environment, there are local variations and exceptions to each. To give two examples: hazardous shoal waters extend southwest from the harbor at Aigina town (ancient Kolonna) through the islet of Metopi to Angistri; and strong westerly to northwesterly winds can blow from the Gulf of Corinth to produce severe gusts along the western side of the Saronic south to Epidauros (Heikell 2002: 61, 74–75). Further, each anchorage has unique characteristics that vary during the course of the year; the reader is referred to the discussion of Kapsali Bay, Kythera in Chapter 4 for an account of typical Aegean variability.

Sea travel in the Saronic is enhanced by large and small islands and moderate distances throughout. No trip within the Gulf approaches the 100-kilometer daily range proposed in the previous chapter for Bronze Age sailing under normal conditions. Even paddled longboats of the EBA could complete virtually any one-way trip in a single day given the 40-kilometer range proposed by Broodbank (2000: 287–289), and many round trips were possible in a day or less (Fig. 7.2). There are many islands of all sizes in the Saronic, even if we discount the tiny rocks that could not accommodate even a small boat. There are two particularly large islands, Aigina and Salamis, and in this category we might also count the *presqu'isle* of Methana, attached by the narrowest of necks to the Peloponnesian mainland but behaving in most respects as an island. Just a bit smaller is the island of Poros, in this case separated from the mainland only



7.2 Comparative ranges of transportation modes in the Saronic Gulf region. Pullen and Tartaron 2007: 154, fig. 14.4. Courtesy of the Cotsen Institute Press.

by a narrow channel several kilometers south of Methana. Angistri to the west of Aigina is somewhat smaller than Poros, but after this there is a drop-off to very small and tiny islands with far fewer usable anchorages. Nevertheless, for the reasonably experienced sailor there is shelter and good anchorage within reach throughout the Gulf.[1]

The Saronic Gulf is a crossroads by sea and land. By sea, it is the entrance from the open Aegean to the land masses of western Attica and the northeastern Peloponnese. From the Cyclades, the Saronic is the sea passage to the Isthmus of Corinth, and by crossing that narrow neck of land, to the Corinthian Gulf and the West. The presence of Aiginetan pottery at coastal sites on the Corinthian Gulf in the MBA suggests that the Isthmus was already used for that purpose. The Isthmus was also the land connection from southern to central Greece. At various times in history, states centered at Aigina, Corinth, Athens, and Nauplion laid claim to control of the Saronic as a fundamental basis of their economic and political power.

The Social Environment of the Saronic Gulf

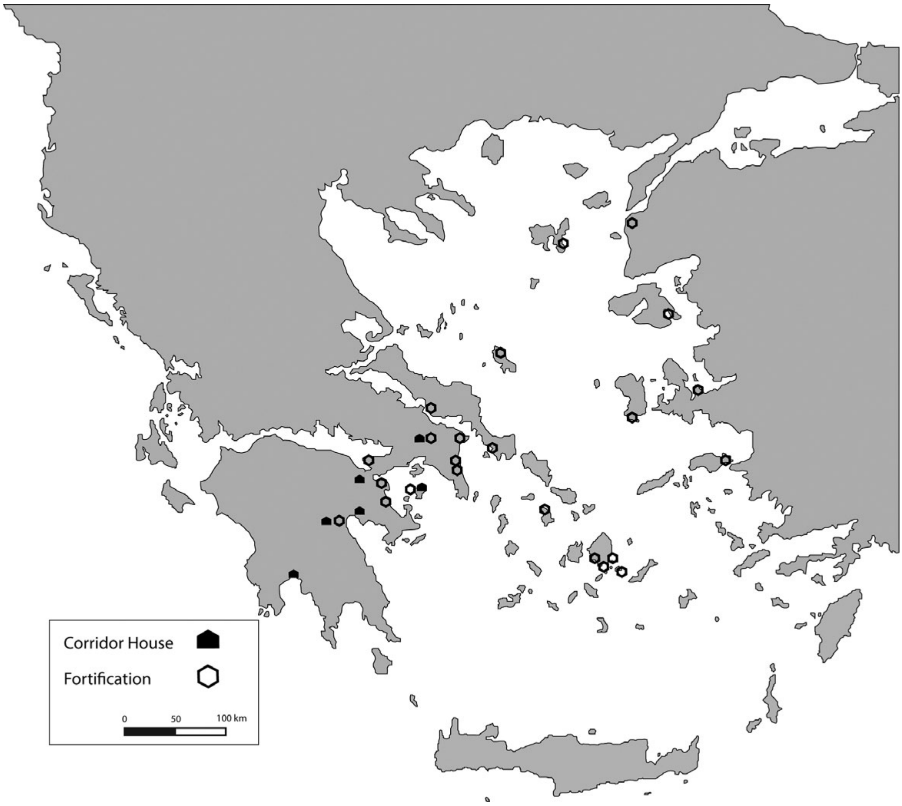
An argument for the existence of a Saronic small world can continue with a phenomenological perspective. Aigina is situated in the geographical center of the Saronic Gulf, with the land masses of Attica, the Corinthia, and the Argolid nearly encircling it. Intervisibility to and from Aigina is exceptionally high:

Aigina is a large island with a distinctive shape – the pointed peak of Mt. Oros is unmistakable – that looms on the near horizon from most coastal vantage points. With some exceptions, the Saronic coastline is rugged, with an abundance of small anchorages attached to diminutive coastal plains or to sheer coastal cliffs. Small coastal settlements tend to be perched on headlands or limited coastal lowlands backed by high mountains that block views, and easy access, to the interior. Thus the everyday field of view is directed toward the sea, to other coastal settlements, and especially to Aigina. Looking upon the Saronic, one perceives not boundless sea, but islands and coasts occupying much of the horizon at distances manageable for small craft. The phenomenological experience of inhabiting one of these communities reverses the common expression of looking *out* to sea, by giving the sense instead of settlements orbiting around and looking *into* the center at Kolonna. The visual element of connectivity so keenly highlighted by Horden and Purcell finds a perfect expression in the Saronic. We may hypothetically suggest that intervisibility, combined with moderate distances and relatively easy sea voyaging, promoted the perception of being part of an organically constituted, coherent world. Opportunities for forging ties with other coastal settlements must certainly have flowed from these advantages, but at times there must also have been social imperatives, including mutual arrangements to buffer the risk of resource failure, and the practice of exogamy to maintain the genetic viability of small communities and to cement the social ties needed to perpetuate vital relationships (Bintliff 2010).

Kolonna and the Bronze Age Saronic Small World

The promontory of Kolonna on the northwestern coast of Aigina was occupied during the Neolithic period at least as early as the fourth millennium BC. The natural advantages of the site are evident: it is elevated 12 meters above sea level and protected by cliffs on three sides, with a double embayment to the south and north and abundant arable land to the east (Felten 2007: 12). Although the shallow harbor at Kolonna – later Aigina town – was considered in Antiquity to be among the most hazardous in the Aegean to approach, it repeatedly served as the main port of powerful Aiginetan states from the Bronze Age to the Archaic period. This disadvantage did not outweigh the location's other natural benefits, or the social and economic will of the city's inhabitants to succeed in spite of environmental shortcomings.

An incipient maritime small world may have come into being in the Saronic as early as the Late or Final Neolithic. It has been demonstrated that Aigina was the main source of andesite for millstones in Attica and the Peloponnese by the later Neolithic period (Runnels 1985a), and a "Saronic" fabric that appears macroscopically to be tempered with volcanic-related inclusions characteristic of Aigina is common among the FN to EBA pottery sherds recovered during a



7.3 Map showing the locations of corridor houses and fortifications in the EB II Aegean. After Tartaron, Pullen, and Noller 2006: 147, fig. 3.

recent surface survey in the Korphos region (D. Pullen, personal communication 2001). The center at Kolonna comes into clearer focus in a mature phase of EB II in the Aegean. This was a time of increasing social complexity that witnessed the emergence of chiefdoms, the erection of fortifications at many sites, and vigorous exchange of exotic items with presumably high social value, including bronze daggers and tools, metal jewelry, fine drinking and pouring vessels of metal, and ceramic and marble vessels and figurines; in short, an era of "international spirit" (Renfrew 1972: 451–55). The relatively undifferentiated pattern of small farmsteads and hamlets in the preceding EB I period was transformed by a striking expansion of settlement and the appearance of large settlements, particularly at coastal locations oriented to maritime activity (Broodbank 2000: 279–87; Konsola 1986; Pullen 2003). This was also the time of the monumental "corridor houses" with long passages flanking the internal rooms found on the Greek mainland and at Kolonna itself (Fig. 7.3). These structures have been variously interpreted as palaces, administrative centers, residences of prominent families or lineages, or even hotels or meeting halls for traders (Felten 1986; Nilsson 2004; Pullen 1986; Shaw 1987; Weingarten 1997; Wiencke 1989).

Bronze Age Kolonna is a highly complex archaeological site, with nine separate urban phases or "cities," including massive fortification walls that were modified and strengthened over a period of 500 years (Table 7.1). From the EBA to the beginning of the LBA, roughly 2500 to 1400 BC, Kolonna was a site without peer in the Aegean outside of the brilliant Minoan civilization on Crete to the south (Rutter 2001: 125–30). Some believe that Kolonna achieved the first Aegean state-level society after the Minoans and before the Mycenaeans (Niemeier 1995).

During EH II (Kolonna phases II–III; circa 2700–2200 BC), Kolonna was a modest settlement of mudbrick houses, but had already begun to distinguish itself from other coastal and island sites in the Saronic and beyond. There is evidence of economic specialization in the production of textiles in the "Färberhaus" (phase III) and storage of agricultural surplus in the "House of the Pithoi" (phase III; Felten 2007). The monumental corridor house known as the "Weißes Haus" of phase III (along with its predecessor the "Haus am Felsrand" of phase II) may have played a central administrative role in the community. In its layout and construction, the Weißes Haus exhibits particularly close parallels to the House of the Tiles at Lerna, indicating early and meaningful relations (Shaw 2007; Wiencke 2000: 298–303). Ongoing excavations at Kolonna are revealing a number of large buildings in phase III, however, so the former impression of the Weißes Haus as singular in its size and complexity may be giving way to the picture of " . . . an accumulation of more or less homogeneous self-sufficient unities" (Felten 2007: 13).

By the latter centuries of the second millennium in EH III (Kolonna phases IV–VI early; circa 2200–2000 BC), Kolonna had been transformed into one of the most significant urban centers of the Aegean: a densely populated, heavily fortified town with monumental stone buildings and sophisticated town planning with buildings arranged in insulae separated by gravel roads. Beginning in EH III, pottery was imported, and stylistic influences on local pottery were adopted, from the Peloponnese, central Greece, and the Cycladic islands (Gauß and Smetana 2008: 329, 2010: 167); and by the beginning of the MBA, these same areas had begun to import Aiginetan tableware, storage vessels, and cooking pots (Lindblom 2001: 40–42, 131–32). There is some evidence in phase IV for a copper-smelting operation.

By EH III, all around Aigina the "international spirit" had broken down, ushering in a period of diminished activity and even abandonment over much of the Saronic and northeastern Peloponnese, which endured until the last phases of the MBA. Although there are variations across the area, the trend is a strong one that is clearly documented by both survey and excavation data (Wright 2004: 119–28). The inland Nemea Valley in the southern Corinthia is a particularly well-studied example, having been targeted by an intensive surface survey and a long-term excavation at Tsoungiza, its most prominent

Table 7.1. Chronological chart for Kolonna (after Wild et al. 2010: 1020, table 3)

Cultural period, conventional (high) (a) and historical chronology (b)	Settlement phase	Ceramic phase	Research areas				Imports first appearance	Boundary between ceramic phases		
			1	2	3	4			Modeled calibrated date 68.2% probability (d)	Modeled calibrated date 95.4% probability (d)
Neolithic to EH I	I	Phase A (c)								
	II	Phase B								
EH II	III	Phase C								
a: EBA II Late: 2450/2350 to 2200/2150 BC	III (Rebuild.)	Phase C								
	IV	Phase D					Peloponnese			
EH III	V (Destr.)	Phase E						beginning of E	earlier than 2181 BC (e)	earlier than 2136 BC (e)
a: EBA III: 2200/2150 to 2050/2000 BC	V (Reconstr.)	Phase E					Central Greece			
b: EBA III/MBA transition: 2160 to 2025 BC								boundary E/F	2191 to 2169 BC	2196 to 2111 BC
	VI	Phase F					Cycladic (schist fabric)			
							Local Cycladic imitations			
	VI	Phase G						boundary F/G	2183 to 2154 BC	2191 to 2064 BC
MH I	VII	Phase G					Lustrous Decorated			
a: MBA I: 2050/2000 to 1950/1900 BC	VIII	Phase H						boundary G/H	2139 to 2061 BC	2150 to 2041 BC
b: MBA I: 2160/2025 to before 1800 BC	VIIIA	Phase H					Minoan, Cycladic (Melos/Thera)			
MH II	IX	Phase I						boundary H/I	2007 to 1904 BC	2049 to 1822 BC
a: MBA II: 1950/1900 to 1750/1720 BC							Local Minoan imitations			
b: MBA II: before 1900 to 1700 BC										
MH III	X	Phase J						boundary I/J	1811 to 1745 BC	1873 to 1702 BC
a: MBA III: 1750/1720 to 1680 BC										
b: MBA III: 1700 to 1600/1580 BC										
LH I	X	Phase K						boundary J/K	1707 to 1648 BC	1742 to 1623 BC
a: LBA I: 1680 to 1600/1580 BC							Southeast Aegean			
b: LBA I: 1600/1580 to 1510/1485 BC										
LH II		Phase L						boundary K/L	1661 to 1591 BC	1679 to 1538 BC
a: LBA II: 1600/1580 to 1445/1415 BC										
b: LBA II: 1510/1485 to 1400/1390 BC								end of L	later than 1610 BC (e)	later than 1644 BC (e)
		Hiatus								
LH IIIA		Phase M					Cypriote	beginning ofM	earlier than 1285 BC (e)	earlier than 1259 BC (e)
a: LBA IIIA: 1445/1415 to 1340/1330 BC										
b: LBA IIIA: 1400/1390 to 1340/1330 BC								end of M	later than 1367 BC (e)	later than 1382 BC (e)

Research Areas
1) Fortification Wall
2) "Inner Settlement" (Innenstadt)
3) South Slope, Q-trenches (Südhügel)
4) Well Deposit

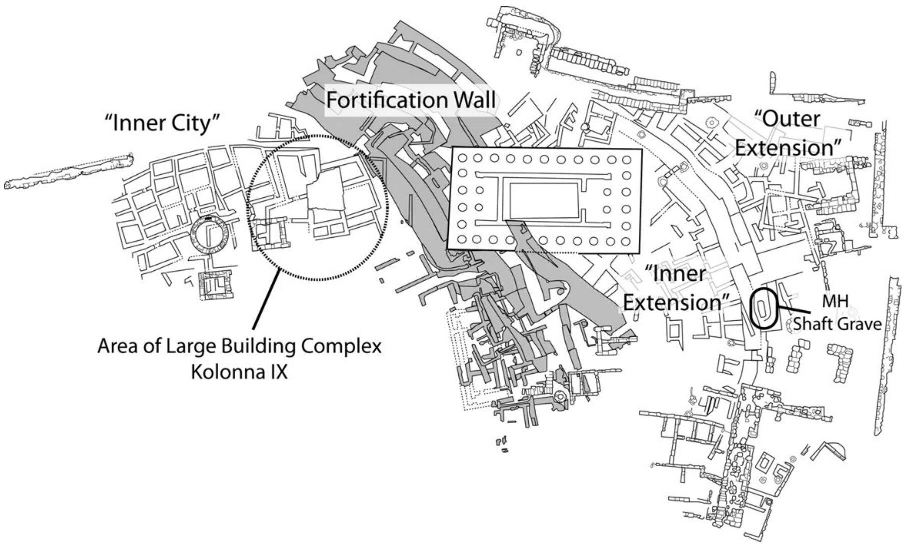
—— vertical stratigraphic sequence

------ existing deposits, but not in vertical stratigraphic sequence

Notes:
(a) long absolute chronology for the Aegean Bronze Age based on the few presently published ^{14}C dates;
(b) historical chronology based on the Egyptian Chronology and its relations to the Aegean;
(c) with subphases (A1, A2, etc.);
(d) time range for the respective confidence level (1σ and 2σ);
(e) no time range is given for boundaries at the beginning or the end of the sequence or hiatus.

prehistoric settlement. These investigations indicate that the valley suffered virtually complete abandonment from sometime in EH III to MH III/LH I, a phenomenon sometimes known as the "Middle Helladic hiatus" (Cherry and Davis 2001: 151–55; Wright 2004: 119–28; Wright et al. 1990: 628–29). The reasons for this nadir in human activity are not well known: in the case of the Nemea Valley, flooding of the valley floor has been postulated (Cherry and Davis 2001: 155–56); elsewhere, finds of daggers, spear points, and sling stones at fortified coastal sites in the Aegean suggest violent destructions (Branigan 1999; Doumas 1990).

By contrast, Kolonna, almost uniquely in the southern mainland region, grew in prosperity and complexity through MH (circa 2000–1600), establishing relations beyond the Saronic with central and northern Greece (Maran 2007; Sarri 2007), the Cycladic Islands (Crego 2007; Gauß and Smetana 2008; Nikolakopoulou 2007; Overbeck 2007), the Argolid (Nordquist 1995: 44, 50–51; Philippa-Touchais 2007; Touchais 2007; Zerner 1978: 156–58, 1993: 48–50), and Minoan Crete (Gauß 2006; Gauß and Smetana 2007: 61–65; Hiller 1993). The prosperity of Kolonna's MBA inhabitants is evident in the material remains. By MH I, the community had expanded beyond the fortification wall to an "inner extension" or "inner suburb" that was then enclosed with a less imposing wall; still later, in early Mycenaean times, a further "outer extension" enlarged the urban area to almost the entire promontory (Fig. 7.4). Notable is the so-called Large Building Complex, founded early in MH just inside the massive fortification wall, and persisting until early Mycenaean times spanning several major architectural phases (Gauß and Smetana 2010). The footprint of the complex may have reached 680 square meters in the MBA, making it one of the largest known structures on the mainland; it has been interpreted as a mansion with a possible administrative function suggested by a clay stamp and a clay seal (Gauß and Smetana 2010: 172). The finds from the Large Building Complex include enormous amounts of pottery and faunal remains. The pottery of the complex's second architectural phase (Kolonna IX) comprises imports from the Cyclades and Minoan Crete, locally manufactured vessels of Minoan type, Aiginetan matt-painted (Siedentopf 1991), and solid painted. The imported and imitation Minoan pottery demonstrates not merely close exchange relations with Crete, but also the possibility that Minoan craftsmen (potters, at least) were resident on Aigina (Gauß 2006; Hiller 1993). The local vessels of Minoan type exhibit significant departures from Aiginetan potting traditions: they are wheelmade, they lack the omnipresent potters' marks found on contemporary Aiginetan vessels, and their forms are dominated by small, open shapes and cooking ware (Gauß and Smetana 2007: 63, 66). Other objects that testify to Minoan influence, if not presence, are an ashlar block with a Minoan-style double-axe mason's mark reused in a Late Roman context (Niemeier 1995: 78), a Minoan-type loomweight, fragments of three Minoan stone vases, a ceremonial



7.4 Site plan of Bronze Age Kolonna, Aigina. After Gauß and Smetana 2007: 58, fig. A.

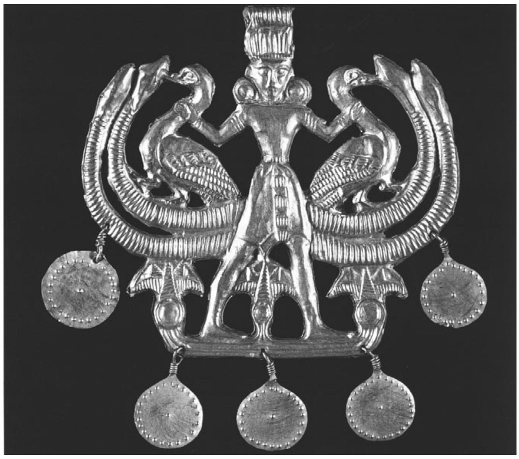
stone hammer, Minoan jewelry, a stone *kernos*, and fragments of a potter's wheel (Hiller 1993: 199).

Analysis of botanical, faunal, and human skeletal remains from the recent excavations at the Large Building Complex has revealed important information about how some inhabitants of Kolonna lived and died in the MBA (Forstenpointner et al. 2010; Galik et al. 2010; Kanz et al. 2010). The plant remains are dominated by the domesticated grain crops emmer wheat, bread wheat, and barley, with lentils as the main identifiable pulses. Grape, fig, and olive were also cultivated. The faunal assemblage consists of 3,178 terrestrial and 1,772 aquatic specimens. The terrestrial animals are overwhelmingly domesticated livestock, predominantly sheep/goat (66%), with lesser amounts of pig (20%) and cattle (14%). Only miniscule numbers of wild animal bones are present. This is a fairly standard faunal assemblage for the MBA and LBA, although the mix of domesticates varies and Gerhard Forstenpointner and colleagues note that the high percentage of sheep and goat is more characteristic of the Aegean Islands and Crete than the mainland, where cattle are more prominent. The remains suggest a mixed livestock economy in which both primary products (meat, hides) and secondary products (milk, hair, wool) were used, but a large percentage of animals were not slaughtered before four to five years of age. The inhabitants of the Large Building Complex also consumed fish, shellfish, and snails. Mollusks (bivalves and gastropods) make up 67% of the marine assemblage. Fish are perhaps underrepresented because of poor preservation of small bones, yet several species including dentex, pandora, sea bream, grouper, barracuda, and mullet indicate a mix of near-shore and open-sea fishing. Remains of fins, ribs, and scales imply processing on site. Alfred Galik and colleagues

also find closer parallels for the marine assemblage in Middle and Late Minoan Crete (e.g., Kommos) than in contemporary mainland sites. Taken together, these studies portray a varied and robust diet, but it must be remembered that the material comes only from the limited context of the Large Building Complex, an apparently elite setting where residents might be expected to have access to a better diet than others at Kolonna or in other settlements on the island.

The study of 48 subadult human skeletons recovered from intramural burials – chosen because Kolonna's adult cemeteries have not been located – produced results that support the impression of a generally prosperous community. The burials come from excavations of the last 20 years and range chronologically from EH I to LH (subphase not specified). Although these individuals died in utero (stillbirth), immediately or shortly after birth, or within the first year of life, there are few signs of malnutrition of the mother during pregnancy, or stress response in respiration, nutrition, or blood circulation after birth. Instead, death is more often attributed to perinatal failure: prematurity, congenital defects, acute diseases, and birth complications occurring at or immediately after birth (Kanz et al. 2010: 483–84). Stillbirth and death shortly after birth were surely common, unavoidable occurrences in the Bronze Age. A lingering question is whether meaningful trends can be extracted from a small sample spread over almost 2,000 years, but if it is accepted that the data fairly represent general trends in the health of Kolonna's population, a comparison with children at Lerna and Asine shows a much lower occurrence of malnutrition at Kolonna as measured by rates of dental hypoplasia and other indicators of metabolic problems.

The wealth and wide connections of Kolonna's inhabitants are suggested by the so-called Aigina Treasure. The mysterious history of this hoard, if that indeed is the right term for it, is well known (Higgins 1979), but recently new information has emerged, leading to a conference in which the historiography of the treasure was updated (Williams 2009) and the objects were reanalyzed stylistically and technically (Fitton 2009). The hoard is a spectacular collection of gold jewelry, comprising earrings, pendants, diadems, bracelets, necklaces, rings, and plaques, with lapis lazuli, amethyst, jasper, and rock crystal beads as secondary decorations (Fitton et al. 2009; Fig. 7.5). There is a basic consensus among scholars that the treasure probably did originate on Aigina in the MBA and should be viewed as a group that may have been looted from a MH tomb.[2] Most accept that the pieces could have been made in an Aiginetan workshop, but not necessarily all in the same generation. The widest divergence of opinion concerns the identity of the craftspeople and the techniques and stylistic influences intrinsic to the individual pieces. Stefan Hiller (2009) supposes that Minoan artisans, part of a small but affluent colony residing on Aigina, created such jewelry mainly for their own community, at the same time as their fellow expatriates manufactured Minoan-style vessels. While Hiller's scenario



7.5 "Master of Animals" pendant from the Aigina Treasure. © Trustees of the British Museum.

assumes that most of the objects find their closest parallels in Minoan typology and iconography, other scholars favor comparanda from the Near East, Anatolia, Egypt, or the Greek mainland as inspirations for individual objects (various contributions to Fitton 2009; Koehl 2011). Perhaps the most useful statement one can make is that the Aigina Treasure underscores the unusual wealth and wide foreign connections that the community at Kolonna enjoyed in the MBA. The treasure seems to represent a synthesis of influences, perhaps filtered through Cretan connections and individuals.

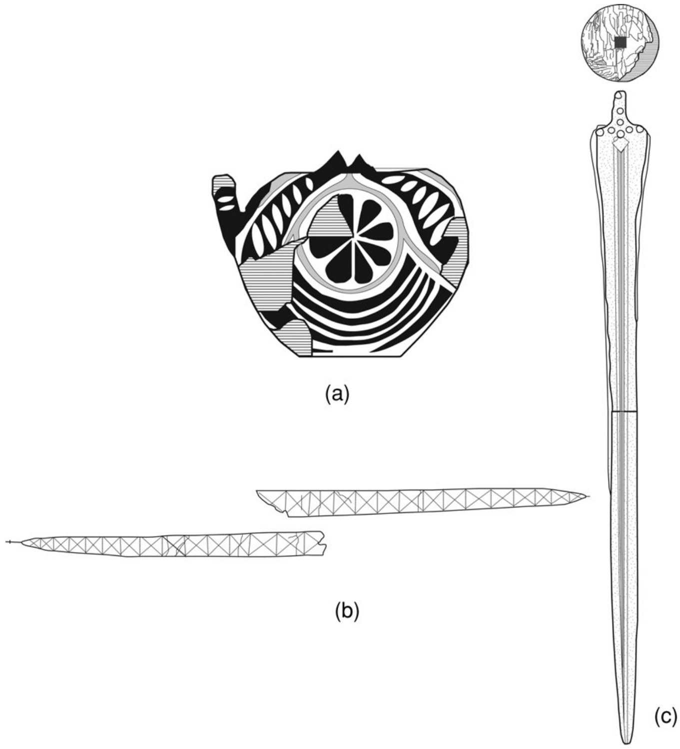
The significance of the Aigina Treasure is highlighted by the more recent discoveries at Kolonna of an EH III hoard and a warrior's grave of MH II. The hoard, excavated in 2000 in House 19 of the "inner town," bears some similarities with the later Aigina Treasure in its content and wide geographical affinities. It consists of a number of gold pins with loop terminals, gold and silver bracelets, several gold and silver pendants with embossed and wire decoration, and one or more necklaces with beads of gold, silver, carnelian, faience, and rock crystal (Felten 2007: 15, 2009: 34–35). The traditions from which these pieces come include northeastern Aegean, Anatolian, Levantine, Mesopotamian, and Cretan. This hoard has several important implications. It implies that in EH III an elite group already existed that could assemble such a rich collection of precious jewelry, and thus the Aigina Treasure may be part of a much longer local tradition. Furthermore, since those who hid the jewelry lived in a period before the earliest Minoan objects appeared in MH I, they were apparently able to forge such far-flung connections without Cretan intermediaries.

The warrior's grave is conventionally known as the Middle Bronze Age Shaft Grave of Aigina, and it is explicitly offered as a forerunner of, and possible model for, the somewhat later shaft graves at Mycenae (Kilian-Dirlmeier 1997).

Opinion is divided on whether it is a true shaft grave, however; according to Oliver Dickinson's (1977: 56) widely recognized definition, a shaft grave comprises a rectangular shaft cut into soft rock and earth, with built or rock-cut ledges some way down the shaft on which a roof of wooden beams would rest, creating a cavity for the burial chamber below it. The roof was covered with clay and the shaft above it was then filled with earth, stone, and sometimes offerings from a funerary meal. A tumulus might finally be raised above the grave. The Aigina grave does not entirely match this definition, in that the cut shaft is extremely shallow, with most of the grave built up of limestone rubble. There is no indisputable ledge, though Imma Kilian-Dirlmeier has plausibly detected a horizontal row of flat stones that could have served to hold in place a roof that does not survive (Kilian-Dirlmeier 1997: 17, fig. 4). Others have classified the burial as a "built tomb" or a "built cist" (Cavanagh and Mee 1998: 27; Hiller 1989: 138–39). The consequence of this debate is that it may not be possible to hold up the Aigina tomb as the model for the form of the later shaft graves at Mycenae, Lerna, and Ayios Stephanos; it must be pointed out, however, that the earliest shaft graves in Grave Circle B (MH IIIA–IIIB) at Mycenae do not display the fully developed, canonical form of the later (end of MH to LH IIA) examples (Graziadio 1988).

On the other hand, the prominent location and contents of the shaft graves at Aigina and Mycenae betray certain shared conceptions of the status and treatment of the deceased. Both were built in extraordinarily conspicuous locations just outside of the contemporary settlement's walls – in the case of the Aigina shaft grave, against the outer face of the enclosure wall of the inner extension during Kolonna IX. This may have been a unique honor; unlike those at Mycenae, the grave seems not to have been part of a cemetery, unless the latter was destroyed by construction during later periods. Kilian-Dirlmeier (1997: fig. 35) restores a 2-meter-thick tumulus over the shaft grave at Kolonna; the grave circles at Mycenae may have been covered by a low mound, separate mounds over individual graves, or no mound at all, but at both sites these reconstructions remain hypothetical (Mylonas 1966: 89–90).

The grave offerings at Kolonna are often thought of as a sampling, on a more modest scale, of the riches to come in Grave Circle A at Mycenae, but a better comparison is Grave Circle B, closer in date to the Kolonna shaft grave and less opulent in grave goods. The contents of the Kolonna burial include a bronze sword with a gold hilt and ivory pommel; several bronze daggers, including one with a decorated gold sheet molded around the handle; a bronze spear point; a gold diadem decorated with repoussé crosses; a gold knife with gold animal-head fittings; boar's tusk plaques from several helmets; six obsidian arrowheads; Minoan pottery of mature Kamares style dating to MM II; Middle Cycladic pottery from Melos and perhaps elsewhere in the Cyclades; and local matt-painted and plain vessels for drinking, eating, pouring, and storage



7.6 Examples of imported and high-status objects from the Aigina MH II "shaft grave." (a) Kamares Ware vessel, imported from Crete, MM II; (b) gold diadem; (c) bronze sword with ivory pommel and gold fittings. After Kilian-Dirlmeier 1997: p. 28, fig. 27:16 (vessel); p. 19, fig. 6:9 (diadem); p. 18, fig. 5:1 (sword).

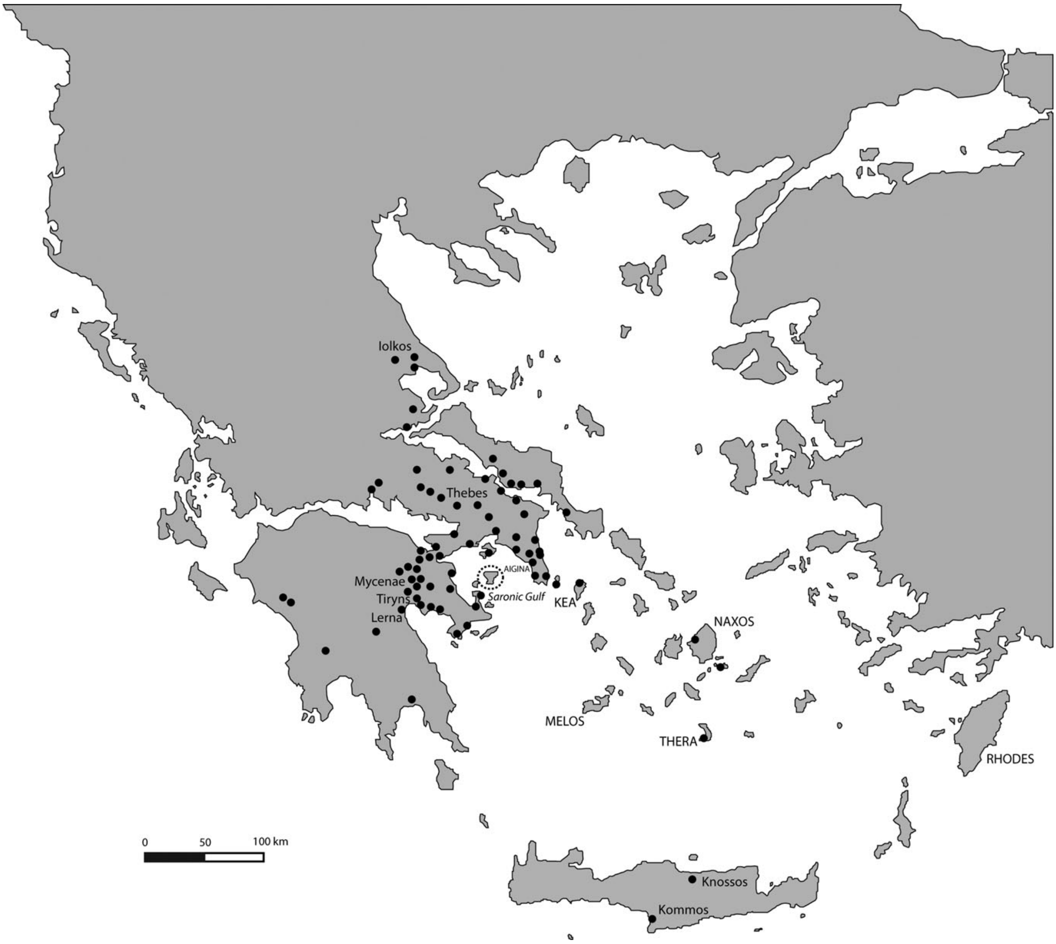
(Kilian-Dirlmeier 1997; Fig. 7.6). It has been noted that the artisanship and decoration of the metal objects reflect mainland rather than Cretan traditions (Hiller 2009: 37), a claim supported by the similarity of motifs on the molded gold sheet to those on locally manufactured matt-painted pottery (Kilian-Dirlmeier 1997: 57). The pottery fits well with the assemblage of local and imported wares in Kolonna settlement IX, ceramic phase I, chronologically equivalent to MH II (Gauß and Smetana 2007: 63, 66) and roughly contemporary with the Aigina Treasure.[3]

All of these artifact types are present in abundance in the shaft graves at Mycenae. Like many of the interments in Grave Circles A and B, the Kolonna shaft grave contains a warrior burial of a type that persists through the Mycenaean period and survives the collapse of the palaces (Deger-Jalkotzy 2006). That the elite individuals and families marked out by these shaft graves enjoyed preeminent status within the community is demonstrated by their setting and rich offerings, but it is specifically the warrior status of the individual buried at Kolonna that prefigures the striking (and decidedly un-Minoan) Mycenaean

preoccupation with martial equipment and iconography, as well as the possibly decisive role of violence in the emergence of the Mycenaean palace states (Acheson 1999; Bennet and Davis 1999; but cf. Wolpert 2004). The twin concerns with maritime and warlike pursuits (and perhaps even with naval warfare) are highlighted in a small number of MH Aiginetan matt-painted barrel jars decorated with ships and in one case a scene of armed warriors aboard a rowed ship (see Fig. 3.10; Rutter 2001: 128–30; Siedentopf 1991: fig. 4, pl. 38.162). There are very few Aiginetan pottery vessels deposited with the dead in Grave Circles A and B, undermining notions that Aigina had direct involvement in Mycenae's emergence to complexity. At the close of the MH period, however, Kolonna's long-standing relationship with Crete may have provided a conduit for Mycenae's initial contacts with the Minoan world. More likely than this is that Kolonna's massive fortification walls, paralleled in the contemporary Aegean only at Troy and Kea (Niemeier 1995: 75), and the precocious warrior burial, exerted a strong influence on an aspiring elite familiar with the prowess and the products of the island polity.

During the MH demographic free fall in Attica and the northeastern Peloponnese, the Aiginetans leapfrogged these areas to establish longer-distance trade relations with central Greece, the Cycladic Islands, and Crete. The impressive distribution of Aiginetan pottery plots the maritime routes over which the cargoes were moving, as well as overland routes by which fewer pots made their way to inland settlements (Fig. 7.7). Goods from Aigina may have been transferred across the Isthmus of Corinth to sites in central Greece along the Corinthian Gulf (e.g., Kirrha, Eutresis) through intermediaries living in the northern Corinthian plain. A number of sites in this intermediate zone, including Korakou, Gonia, Peridkaria, Aetopetra, Arapiza, and Ayios Gerasimos, seem to have been occupied from EH III through the Mycenaean period (Lambropoulou 1991: 144). They seem to have coexisted in a stable, heterarchical settlement pattern over much of the Bronze Age (Pullen and Tartaron 2007: 148, 150–52). During MH, their only detectable external contacts were with Aigina, indicated by the presence of matt-painted, red-slipped and burnished, and coarse plain and cooking vessels in Aiginetan gold-mica fabric. At Gonia, these types constitute 19% of the total ceramic assemblage; at Korakou the figure is 9% (Lambropoulou 1991: 145).

Because there has never been a systematic site survey on Aigina, the handful of known MH sites have been discovered as the result of informal explorations or as chance finds. In the mid-1990s, the MH catalogue consisted of eight confirmed sites and eleven uncertain sites (Fig. 7.8). These sites are mainly sherd scatters or occasionally graves, but beyond Kolonna architecture is lacking. It is at present impossible to know if this pattern is a fair representation of reality, and we are not in a position to answer Wright's (2010: 808) query concerning whether there were centers on the island apart from Kolonna serving as magnets for



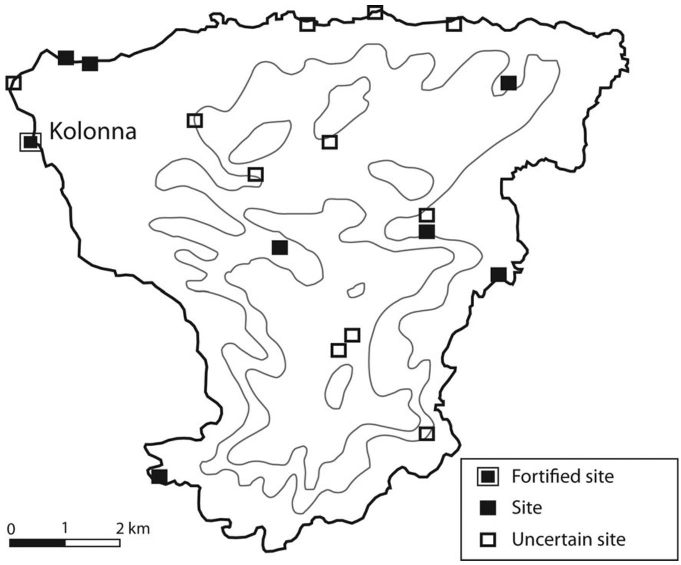
7.7 Distribution of Aiginetan "gold mica" pottery exports. After Rutter 2001: 127, fig. 12, with additions.

small villages and hamlets. Very small amounts of MBA material have been recovered in excavations at Lazarides, an elevated site in east-central Aigina with views over most of the Saronic (Sgouritsa 2010), and at the location of the later temple of Aphaia in the northeastern corner of the island (Pilafides-Williams 1998: 82–83, 156). These and other sporadic finds are not suggestive of alternative centers, or of a complex hierarchy of sites below Kolonna. There is a comparable dearth of MH I–II sites around the Saronic, but an important exception is the recent discovery at Megali Magoula near Galatas, across from Poros, of a small but impressive settlement enclosed by an elliptical fortification wall (Konsolaki-Yiannopoulou 2003a, 2010). The MH pottery is a mixture of Peloponnesian and Aiginetan types with a chronological concentration in MH II. Alongside mainland gray Minyan and Argive Minyan, much of the fine to semi-fine matt-painted pottery is Aiginetan, including large and small basins and a

few examples of cylindrical pyxides and barrel jars. Megali Magoula prospered along with Kolonna IX and X, perhaps in part by serving as intermediary for Aiginetan products with trade partners in places like Lerna and Asine (Konsolaki-Yiannopoulou 2010: 73).

At the end of the MBA, Kolonna X (MH III–early LH) witnessed a further expansion of the town to the east, enclosed by yet another wall in early LH, this time of large rubble construction reminiscent of cyclopean masonry. The ceramic evidence suggests that the outward focus that the Aiginetans had maintained on more distant trading partners during the Middle Helladic hiatus shifted back to the regions surrounding the Saronic Gulf, where two related transformations were taking place starting in MH III/LH I: the "colonization" of the interior of the northeastern Peloponnese, which saw resurgent populations establishing new sites or reoccupying old ones that had been effectively abandoned since the late third millennium (Rutter 2007: 42–43); and the social, political, and economic developments of the Shaft Grave Era, most prominently the emergence of complexity at Mycenae. The Aiginetan ceramic industry responded to the increased demand for household pottery closer to home by expanding production in a range of standardized and specialized forms: larger closed and open vessels including water jars, barrel jars, and kraters; smaller drinking and eating vessels such as goblets, *kantharoi*, and handleless bowls; and four types of cooking pots (Rutter 2007: 36). A pottery kiln dating to the early years of LH that was recently excavated in the southwestern part of the Large Building Complex may have played a role in the increased production. The Saronic small world centered on Aigina was thus revived, starting in MH III and peaking in LH I–II. This was the era of the greatest cohesion of the Kolonna-centered Saronic world, and for most sites in the Saronic and northeastern Peloponnese, the time of greatest abundance of Aiginetan imports (Lindblom 2001: 41–42).

Mycenae was not yet connected in any meaningful way to this network, but soon would be. Before we turn to the expansion of Mycenae, it is worth reflecting on why Kolonna had become such a monumental settlement with such broad contacts, and why the pottery produced on the island was one of few Aegean products to be so widely disseminated. It was partly a matter of Aigina's fortunate geographical position, and the opportunities for efficient transport by sea. It had also to do with the excellent sources of clay and temper to which potters at Kolonna had access. Moreover, Kolonna filled a power vacuum, surviving and flourishing while communities all around disintegrated, by forging new ties with more distant partners. A distinct distribution pattern had developed by the late MH for two main ceramic production and export industries: Aiginetan; and lustrous decorated wares centered in the southern Peloponnese or Kythera (Zerner 1993). In the southern Peloponnese, there is much lustrous decorated and little Aiginetan; in central Greece and Attica, the situation is



7.8 Map of Aigina showing the locations of known MH sites. After Kilian-Dirlmeier 1997: 109, fig. 62.

reversed; and in the northeastern Peloponnese, there is much of both (Rutter 2007: 36).

Many scholars have focused on the intrinsic properties of the Aiginetan pottery itself relative to local and imported alternatives (e.g., Zerner 1993). The Aiginetan product was more standardized in its form, the result of consistent forming and firing practices, including levigation, uniform clay composition, and controlled firing conditions (Philippa-Touchais 2007: 110), lending the impression of greater reliability. Its well-executed and attractive matt-painted decoration was appreciated for its aesthetic properties, inspiring local imitation. There is also strong evidence of superior performance for the pots' intended uses (Rutter 2007: 42). The cooking ware was lighter in weight but better made and more durable than the norm; the porosity of the fabric inhibited cracking during expansion and contraction cycles, while the volcanic rock temper apparently possessed favorable thermal expansion characteristics. The result was higher thermal shock resistance and fewer failures under thermal stress. The several forms of water jug (*stamnoi, hydrias*, amphoras, and large jugs) were larger, lighter, with thinner walls, thus more practical for transporting water, and their porosity promoted evaporation of moisture through the body wall and into the atmosphere, keeping the liquids they contained cooler.

While the performance characteristics of Aiginetan pottery have long been acknowledged, in recent years scholars have attributed to the trade in Aiginetan pottery far more profound influences. Anna Philippa-Touchais (2007: 110–12) asserts that the aesthetic of Aiginetan MBA pottery not only inspired imitations

at Argos and elsewhere, but actually created a network of "common references," a kind of koiné of instantly recognizable shapes, fabrics, and technical excellence that attained an ideological value for local elites wishing to display their connections with an external world in the context of communal feasting.

This sentiment is echoed in studies of Aiginetan ceramics in Thessaly and Boeotia, and at Lerna. Despite the fact that imported Aiginetan vessels are quite rare in Thessaly, Joseph Maran (2007) believes that "Magnesia polychrome," manufactured in or around Pefkakia beginning in MH II, emulates the shapes and decoration of Aiginetan matt-painted pottery. According to Maran, the adoption of these novel table and cooking vessels actually transformed methods of food preparation and consumption. These new practices became strategies in communal eating and drinking ceremonies to emphasize the connection of those who possessed them to elite practices in distant southern Greece. As at Argos, aspiring elites sought to differentiate themselves in society through the use of such exotic objects. Maran sees the spread of this influence, which began with exposure to a limited number of genuine Aiginetan specimens, to the northern Aegean and the Izmir region (Maran 2007: 174). In Boeotia, the aesthetics of Aiginetan pottery had a strong effect by MH II, as potters began to combine Minyan and matt-painted styles. This interaction can be traced through a succession of changes from yellow and red Minyan matt-painted, to polychrome mainland in MH III, and ultimately to Mycenaean style (Sarri 2007: 163). At Lerna, a massive collection of broken pottery and animal bones in the fill of two shaft graves of LH I, representing funerary meals that must have involved hundreds or even thousands of participants, contains Aiginetan pottery in the amount of more than 50% of between 15,000 and 18,000 sherds (Lindblom 2007). In such an obviously communal and symbolically charged event, vessels manufactured at Kolonna, an impressively fortified place possessing a maritime fleet and advanced technological knowledge, could serve as a powerful demonstration that the followers of the deceased had access to a network of social relations beyond the reach of most members of the communities on the Argive Plain (Lindblom 2007: 126). It may have been especially important to display wealth and esoteric knowledge if one purpose of the ceremony was to transfer rights and privileges to an heir of the deceased under potentially contentious circumstances. We might imagine that the Lerna shaft grave deposit represents the kind of competitively charged communal event that Philippa-Touchais and Maran have in mind for Argos and Pefkakia. The social ramifications implicit in the acquisition and use of Aiginetan wares thus extend well beyond the economic value of the pots or the exchange networks that moved them.

An even more direct influence may have been at work in Aigina's relationship with the settlement at Ayia Irini on the island of Kea (Crego 2007, 2010; Overbeck 2007; Overbeck and Crego 2008), just outside the Saronic Gulf. Ayia Irini IVa was founded in a developed phase of Middle Cycladic after a hiatus

spanning the end of Early Cycladic (Ayia Irini III) and the earliest part of the Middle Cycladic. The settlement was apparently colonized from outside, with an intrusive ceramic repertoire including a system of potters' marks; immediate engagement in vigorous trade with the mainland, the Cyclades, and Crete; and an impressive fortification wall. Donna May Crego (2010: 843) points out that there is little evidence for traditional women's crafts, and burials of the period are not yet known, suggesting to her the initial settlement of Ayia Irini IVa by a male, commercially oriented installation rather than a typical village. As for the origin of the settlers, in an earlier article John Overbeck and Crego (2008: 305) pointed to central Greece, perhaps Boeotia, on the strength of the abundance of mainland pottery types such as gray Minyan. More recently, in something of a reassessment, Crego (2010) relocates the settlers to Aigina, highlighting shared elements that add up to a special relationship between the two islands. She sees links to Kolonna in the fortification wall and the system of potters' marks. More salient still are indications of close relations in the ceramic assemblages (Crego 2010: 842–45). Although true Aiginetan matt-painted pottery makes up only around 3% of the pottery corpus of phase IVa at Kea, locally produced yellow-slipped (12%) appears to be an emulation of Aiginetan matt-painted adapted to local clays. Further, the two settlements exchanged vessel types rarely found outside their local contexts: at Kolonna the old and new excavations, as well as the shaft grave, have yielded a range of Keian vessels, including the rare white-on-gray, found in numbers matching those known on Kea itself. In parallel, potters at Ayia Irini manufactured barrel jars and bulbous jars in yellow-slipped fabrics, imitating the shape and appearance of Aiginetan matt-painted prototypes. The latter shape is rare outside Aigina. Crego concludes that Ayia Irini IVa was founded from Kolonna as a trade station to distribute Aiginetan products and to provide access to the metal deposits at nearby Lavrion on the Attic mainland. The wide contacts of the new settlement can be explained by Kolonna's existing maritime network of ties to the mainland, Cyclades, and Crete. In the subsequent phase IVb, commercial interests continued, but the far greater occurrence of burials and women's equipment suggests a fully formed village and an incipient Kean identity separate from Aigina. The dominant influence of Aigina had declined by the late MBA (phase V), when Minoan pottery was imported and imitated, Minoan architectural styles were adopted, and Linear A script was used (Davis 2008: 195). By the following phase VI, corresponding to the beginning of the LBA, Minoan influence was pervasive in every aspect of material culture. If Crego's interpretation of Ayia Irini IVa is accepted (and there are certainly alternative explanations of the evidence; e.g., Davis 2008: 194–96), it shows Kolonna in an expansive mode, extending its small world beyond the confines of the Saronic Gulf.

Aigina's unusual success in production and export, amounting to the better part of a millennium of competitive advantage, might be further illuminated if

we think in terms of connectivity. Recalling the discussion of social network theory in the previous chapter, we can suggest that the principle of preferential attachment (Barabási and Albert 1999), by which new vertices attach disproportionately to sites that are already well connected, applies forcefully to Kolonna's situation in the MBA and early LBA. Kolonna was a peer of several highly developed EH II communities in the northeastern Peloponnese and Cycladic islands, but unlike most others survived the EH III decline as a prosperous community, filling a yawning power vacuum. Although the growth of the Aiginetan potting industry was perhaps stimulated by contact with protopalatial Crete, this cannot explain the initiation of exchange relations with the Cyclades, the Peloponnese, and central Greece, for which the role of intrepid and enterprising individuals must have been decisive. By means of this precocious outreach, Kolonna became more "connected" than any other settlement in the region. As demographic recovery proceeded and new settlements were established in MH III–LH I, a period of continuous growth began with the addition of new vertices and new paths between them, but the huge competitive advantage held by Aiginetan producers in terms of experience, efficiency, and established connections meant that these new nodes connected to Aigina preferentially, in agreement with the ceramic evidence from the Saronic and surrounding areas. Under conditions of continuous growth and preferential attachment, a node that acquires more connections than others will accumulate them at an increasing rate, causing the difference in connectivity to multiply as the network grows (Barabási and Albert 1999: 511). I suggested in Chapter 6 that this dynamic might illuminate the emergence of Mycenae during the Shaft Grave Era or the dominant position of Knossos in the neopalatial period, but we can now apply the same idea to Kolonna's long-term prominence from EH III to LH II. This process, the impetus for which may have originally been economic, was a key factor leading to a situation where the emergence of rival centers of *political* power is suppressed, as argued by Pullen and Tartaron (2007) for Kolonna's relationship with the Saronic region and beyond. A consideration of connectivity within the framework of network theory augments the interpretations of the ceramic evidence, outlined above, to begin to answer Wright's (2010: 808) question: "How do we assess the regional influence or connectedness of Aegina beyond [the Saronic Gulf] area?"

Kolonna and Mycenae in the Late Bronze Age

The expansion of Mycenae's economic and political interests was destined to transform the Saronic Gulf entirely, but this was more a gradual process than the execution of a strategic plan at any one point in time. A brief survey of the evidence of pottery in regions to the north and east of Mycenae is enlightening on this point.[4] The areas of the southeastern Corinthia north of Mycenae, such

as the Nemea and Longopotamos Valleys, have been considered natural targets for Mycenae to expand into virtually empty landscapes in the early years of the Shaft Grave Era in MH III–LH I (Cherry and Davis 2001). But the ceramic evidence suggests otherwise, indicating a strong measure of independence in the early Mycenaean period (Morgan 1999: 358–61; Mountjoy 1999: 197; Rutter 1989, 1990, 1993; Wright 2004: 124–26). Jeremy Rutter (1990: 452–55) has observed that the pottery used by the first group to resettle Tsoungiza finds close parallels not in the Argolid but in late MH graves in the North Cemetery at Corinth. The MH III assemblage is parochial, with a few imports from Aigina, but only general stylistic links with the Argolid and the Corinthia (Morgan 1999: 360). In LH I, Mycenaean-style fineware is rare while imported Aiginetan gold-mica storage, cooking, and mixing vessels comprise between 7% and 10% of the total pottery assemblage (Rutter 1989: 12; Lindblom 2001: 41), with smaller numbers of Cycladic and Cretan pots possibly obtained through Aiginetan intermediaries. Tsoungiza may have looked not south to Mycenae, but west toward the thriving center at Aidonia at this time (Wright 2004: 125). It is not until LH IIA that a significant connection can be demonstrated with Mycenae. Although imports of Aiginetan utilitarian vessels held steady at approximately the same levels as in LH I (Rutter 1993: 82–85, table 1), trench EU 10 produced high-quality Mycenaean fineware, including a Vapheio cup and four piriform jars so similar to examples from Mycenae that they may have come from the same workshop (Mountjoy 1999: 199; Rutter 1993: 74–75, 79). By this time, then, Tsoungiza was being drawn into Mycenae's orbit, although we cannot say with certainty that Tsoungiza had been incorporated politically as opposed to simply participating in economic transactions with an emerging center of pottery production and trade at Mycenae (Rutter 1993: 91). Indeed, in LH IIB both Mycenaean and Aiginetan imports actually declined and the LH IIIA1 subphase is not well known (Mountjoy 1999: 200).

The more distant northern Corinthia was slow to adopt the Mycenaean style. At LH I Korakou, there are a few sherds only of LH I style, and a small number in the palatial and pseudo-Minoan styles of LH IIA (Davis 1979). Instead the main connection in the early Mycenaean period was with Aiginetan trade networks. As mentioned above, this relationship began in the MBA, but by LH I the inhabitants of Korakou were importing a range of Aiginetan cookware, kraters, and large storage and pouring vessels (Davis 1979: 241, 258–59; Lindblom 2001: 41; Morgan 1999: 351; Mountjoy 1999: 199–200). MH traditions persisted longer in the northern Corinthia than in the Argolid: in the East Alley, gray Minyan, matt-painted, and yellow Minyan wares were found together with sherds of Mycenaean LH I and LH II styles (Davis 1979: 256–57).

Mycenaean LH I style is also rare at Kolonna and at the circum-Saronic settlements that imported pottery primarily from Aigina throughout the MBA and early Mycenaean period (Lindblom 2001: 43, table 9; Siennicka 2002: 181–84).

Relatively few sites with good early Mycenaean deposits have been published, and these have produced few examples of Mycenaean LH I. In Attica, it is exceedingly rare; Kiapha Thiti has few sherds if any at all (Maran 1993: 205; Mountjoy 1999: 491–92). Megali Magoula (Galatas) has produced some sherds of Mycenaean painted LH I style from the mounds of earth covering two early tholos tombs; this material seems earlier than the tombs themselves, reflecting settlement pottery rather than grave goods (Konsolaki-Yiannopoulou 2010: 73). If Megali Magoula flourished in MH because of access to the Aiginetan economy, the tholos tombs appear to indicate a later prosperity tied to relations with the Argolid and beyond.

Commenting on exchange systems in LH I, Mountjoy (1999: 20, 492) finds it surprising that lustrous decorated and other early Mycenaean styles should be so rare in the Saronic and the Corinthia, despite the easy voyage from the Gulf of Argos, where they are found in abundance. She notes that the shapes in which Aiginetan workshops specialized, including hydrias, amphoras, and kraters, do not duplicate the fine tableware of LH I style, so redundancy is not an explanation. She speculates that Aiginetan activity might account for the lack of pottery decorated in the LH I style, and that Lerna and Kolonna may have had separate interaction spheres. This seems correct, but I would go further to suggest exclusionary practices – a deliberate strategy of protectionism reflecting not only economic hegemony but also a final phase of Aiginetan political muscle.

LH II marks a transition when Mycenaean pottery of palatial and pseudo-Minoan type found its place at Aigina, Kiapha Thiti, and Athens by LH IIA. Both of these classes were produced locally at Kolonna and Athens (Mountjoy 1999: 492). Among the pseudo-Minoan types, the marine style is found at Kolonna, Athens, Thorikos, and Eleusis. But in that same period Aiginetan imports still made up 7–10% of the corpus at Tsoungiza and 20% at Kiapha Thiti (Maran 1992: 204–211). Mycenaean LH IIB pottery is still relatively little known in Attica, except for some graves at the Athenian Agora, until masses of later LH IIB pottery were dumped into wells on the south slope of the Athenian acropolis (Mountjoy 1999: 492–93). Also included in these deposits is late matt-painted ware, possibly an Aiginetan product.

The appearance of Mycenaean pottery for the first time in substantial quantities marks the initiation of a shift, played out over a period of maybe 50 to 100 years and essentially accomplished in LH IIIA – the early Mycenaean palatial period in the fourteenth century – by which Mycenae swallowed the Saronic Gulf into its economic and political orbit. It is no coincidence that Kolonna's export industry seems to have gone into decline sometime during LH IIIA1, around the time of the establishment of the first verifiable palace at Mycenae (Lindblom 2001: 129–30). The chronological period represented by LH IIIA1 is barely detectable at Kolonna, and few LH IIIA2 deposits in the Aegean have produced Aiginetan imports (Lindblom 2001: 129). By that time, Mycenaean

fineware and utilitarian vessels had superseded most Aiginetan shapes throughout Kolonna's former sphere of influence. (Nevertheless, exports of Aiginetan storage and cooking vessels continued in LH IIIB and IIIC, owing to their superior working qualities as well as the momentum of long-term relationships by which they were exchanged [Lindblom 2001: 41; Zerner 1993: 55].) It is reasonable to assume that this shift in production and consumption patterns reflects the appropriation of the export market by Mycenaeans from the Argolid, but there are also clear signs of political expansion of Mycenae during the palatial period into the southwestern Corinthia and the Saronic Gulf, though probably not the northern Corinthia.

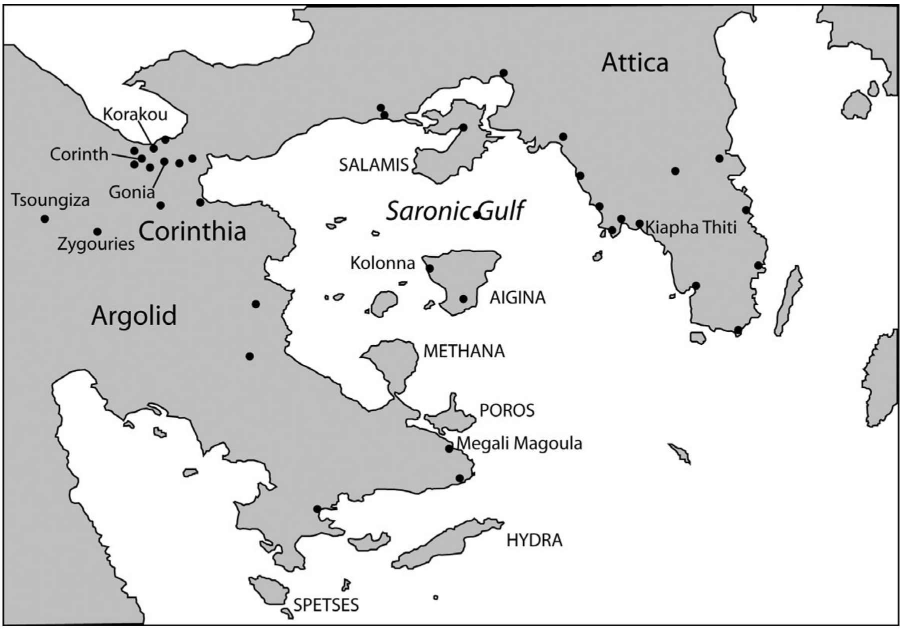
At Tsoungiza in the southwestern Corinthia, a ceremonial feasting deposit of LH IIIA2 (trench EU 9) consisting of cattle bones; drinking, serving, and cooking vessels; and a fragmentary ceramic female figure has been interpreted as the remains of a regional feast intended to cement alliances between elites at Mycenae and Tsoungiza (Dabney et al. 2004). The analysis of a pit with contents dating to LH IIIB1 shows that residents of tiny Tsoungiza had access to the same range and quality of pottery as Mycenae, indicating a close link but not necessarily strict control (Thomas 2005; this may already have been true in LH IIA: Rutter 1993: 90). Patrick Thomas also reinterpreted the so-called potters' shop in House B at Zygouries as a workshop for the manufacture of perfumed olive oil, implying a close link with Mycenae's interests in LH IIIB (Thomas 1992). In the broader sweep of the Mycenaean era, the southwestern Corinthia was only gradually incorporated into the political economy of the Argolid. Wright (2004: 127) has associated the Nemea Valley with a "periphery model," in which such regions exhibit considerable autonomy, participating in alternative social and economic networks before being incorporated into palatial economies to varying degrees in LH III.

A different pattern prevails in the northern Corinthia. There, the numbers of Aiginetan as well as other imported vessels declined in LH IIIA2. During the palatial period, Corinthian fineware shows strong stylistic connections with the Argolid in both forms and decorative motifs, but virtually all pottery vessels and terracotta figurines are believed to have been made locally (Morgan 1999: 353). The absence of true imports from the Argolid makes it highly unlikely that Mycenae dominated the northern Corinthia politically or established a permanent presence there (Pullen and Tartaron 2007; Tartaron 2010).

In the Saronic Gulf, the process of Mycenaean expansion into the region is not easily appreciated because few contexts spanning early to later Mycenaean are available, and in general the early Mycenaean remains are inferior in quantity and quality to those of the later Mycenaean phases (Siennicka 2002). Ongoing investigations at the MH–LH settlement of Megali Magoula offer a window onto the process by which Mycenaean influences insinuated themselves into the Saronic Gulf region (Konsolaki-Yiannopoulou 2003a, 2010). Located in the

southwestern corner of the Gulf, with manageable overland and maritime access to the Argive Plain and the Argolic Gulf, Megali Magoula was well positioned to be an intermediate link between the two bodies of water. As we have seen, a prosperous community of the MBA had strong ties to Aigina, and MH III–LH I sherds found in the fill of the somewhat later tholos tombs show continuity into the LBA. Of the three tholoi, Tomb 3 seems to be earliest, dating perhaps to LH I based on pottery and weapons tenuously associated with the burial(s). The form of the tomb, built entirely above ground with a circular chamber and no dromos, recalls the EM–MM tholoi of southern Crete; Eleni Konsolaki-Yiannopoulou (2010: 72–73) proposes that it may represent, along with the Vagenas tomb in Messenia, a link between Cretan tombs and Helladic tholoi – though of course there is nothing approaching a consensus about the origin of the Helladic tholos (Rutter 2001: 139; Voutsaki 1998: 42–43). If such a connection existed, it might have been part of the cultural expansion of Minoan Crete that affected Ayia Irini at the dawn of the LBA.

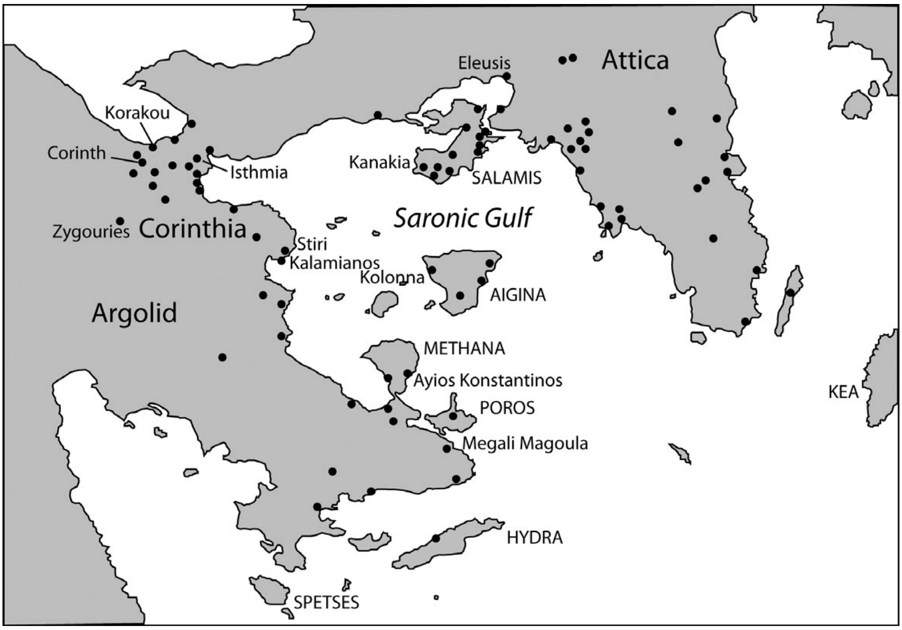
Tombs 1 and 2 are more recognizably Mycenaean tholoi, the architectural features and pottery of which indicate a date in LH IIB for their construction and earliest burials. They are quite different in form. Tomb 1 is a very large tholos ($D = 11.8$ meters) of Pelon's Class C built mainly above ground with an artificial tumulus heaped over it (Konsolaki-Yiannopoulou 2003a: 165–75). Elements of the tomb's construction find parallels in early tholos tombs in Attica, Messenia, and the northeastern Peloponnese. The Mycenaean pottery, while not found in undisturbed burial contexts, indicates that the tholos was in use from LH IIB to LH IIIB. Tomb 2 is a very small example ($D = 3.8$ meters) of Pelon's Class A, rare in the northeastern Peloponnese but common in Messenia, where Minoan influences were strongly felt (Nelson 2001; Pelon 1998). A construction date in LH IIB is also favored, with continuing use in LH III and a concentration of Mycenaean pottery in LH IIIA2–IIIB1 (Konsolaki-Yiannopoulou 2003a: 177–78). Initial use of these tombs in LH II coincides with the first wave of Mycenaean pottery in the Saronic, and we might imagine elites at Megali Magoula now taking their cues from the families burying their dead in early tholoi in Messenia and the Argolid, keeping in mind that the fertilization of Mycenaean culture from Crete was still ongoing. As Kolonna lost its preeminent position in the Saronic in LH IIIA, the wider area of Mycenaean Troizen around Megali Magoula flourished, indicated for example by the rich chamber tomb cemetery at nearby Apatheia, where evidence for libations as part of elaborate funerary rituals parallels similar traces in the Megali Magoula tholoi (Konsolaki-Yiannopoulou 2001). Following Konsolaki-Yiannopoulou's (2010: 73) suggestion that "[t]he fall of Aegina and the rise of Mycenaean Troezen are two parallel phenomena, which may not be disconnected . . . ," it is reasonable to perceive in these changing fortunes the moment at which Mycenaean presence in the Saronic began to have political, not just economic or cultural, ramifications.



7.9 Map of early Mycenaean sites in the Saronic region. After Siennicka 2002: 180, fig. 1.

The archaeological record shows unambiguously what a momentous shift this was (Figs. 7.9, 7.10). The number of known sites around the Saronic increases almost twofold in late Mycenaean times when corrected for phase durations, and numerous new settlements indicate a dynamic expansion (Siennicka 2002: 184–89). Some sites that had long been occupied continued to flourish; for example, in Attica, Eleusis and Ayios Kosmas experienced prosperity and expansion, and the long-established settlements of the northern Corinthian plain carried on as before. But many more of the settlements were new foundations of the palatial period, as Figure 7.10 clearly shows. With some variations, they adopted the typical repertoire of Mycenaean material culture, including pottery forms and styles, architectural techniques, burial customs, and cult practices; in short, they participated in the Mycenaean cultural koiné that formed rapidly in LH IIIA and remained in place until it began to fragment in later LH IIIB. To give a sense of the range of palatial-period communities in the Saronic Gulf region, I will next describe briefly two settlements, Kanakia on Salamis Island and Ayios Konstantinos on the Methana peninsula, before taking up a third, Korphos-Kalamianos, at much greater length. (For a more inclusive survey of LH IIIA–IIIB Saronic settlements, see Siennicka 2002: 184–89.)

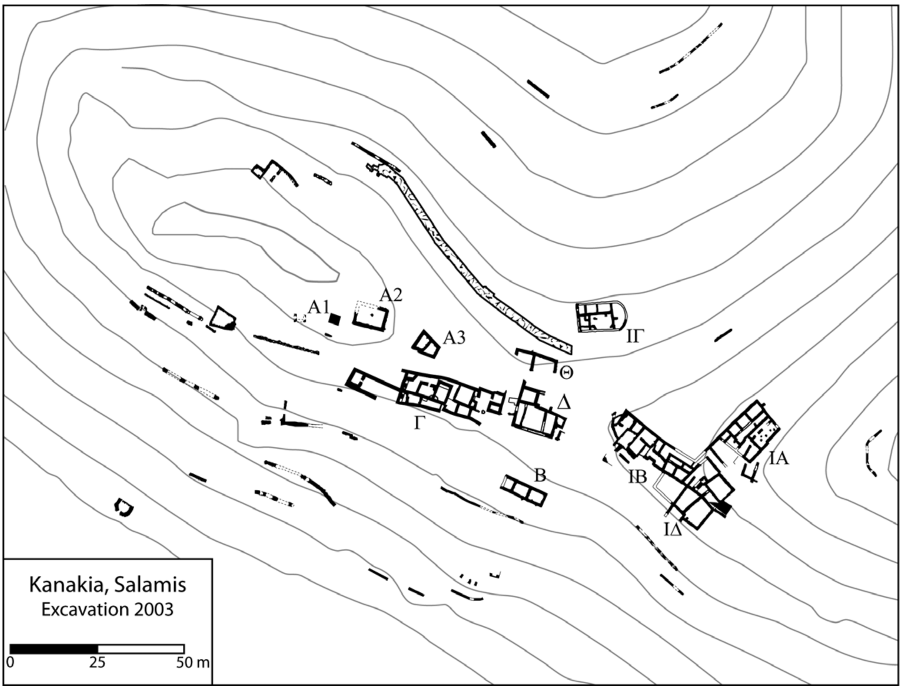
Kanakia was an acropolis-type settlement of LH IIIA–IIIC date in the southwestern corner of Salamis, built on a series of terraces with retaining walls on and around a pair of neighboring peaks (Lolos 2007). The site overlooks two harbors, with a broad viewshed encompassing much of the Saronic Gulf. The



7.10 Map of late Mycenaean sites in the Saronic region. After Siennicka 2002: 180, fig. 2.

built area covers approximately 4.5 hectares, with structures varying in size and plan separated by roads and courtyards (Fig. 7.11). Free-standing structures with one, two, and three rooms have been identified, along with true megara, trapezoidal buildings, and corridor-type buildings such as are known in LH IIIB contexts at Mycenae, Tiryns, and elsewhere. There are also at least two complexes of multiple, attached buildings on the upper areas of the acropolis. The site is unfortified, but the approaches are steep and a system of watch towers seems to have been in place.

Excavations since 2000 have focused on structures within the building complexes of LH IIIB–IIIC date. The structures often rested on multiple levels conforming to the terraced topography; an example is building IA, a LH IIIB corridor house built on two levels with an upper level devoted to working areas where stone tools, pottery, and traces of mineral pigments were found, and a lower-level cellar where pottery vessels were stored. Building IA forms part of a larger industrial complex with buildings IB and IΔ; this compound comprises more than forty rooms and spaces for workshops, storerooms, auxiliary rooms, corridors, courtyards, and paths. The finds of querns, grinders, whetstones, spindle whorls, beads, a hoard of bronze tools in IΔ, and everyday pottery of LH IIIB2–LH IIIC Early are consistent with this interpretation. Some evidence of cult has been found in a couple of buildings, in the form of a number of clay anthropomorphic and animal figurines, the former mainly of phi and psi type, but these attest to ritual practice in household or workshop contexts only.



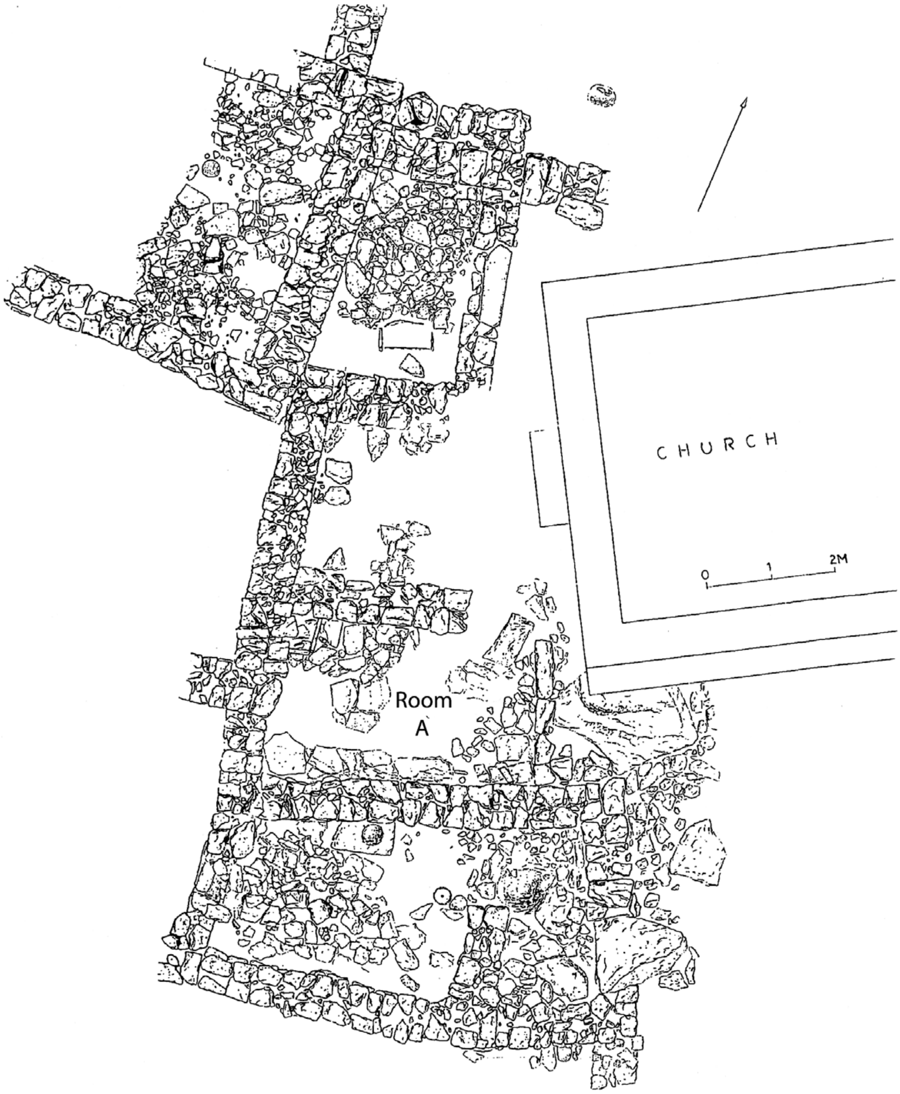
7.11 General plan of Mycenaean Kanakia, Salamis. After Lolos 2007: 238, fig. 4.

Overall, the settlement as revealed to date reflects a working community; as yet no building of truly palatial character has been uncovered. Yet the size of the settlement, the quality of the architecture, and the presence of imported goods suggest that this was an important settlement. Architectural details such as columned entrances (*propylaia*), a large "double megaron" (building Γ, considered by the excavator to be a ruler's residence: Lolos 2007: 235), and a unique, massive tower-like structure attached to a twin gate that controls access to a triangular space all point to a community of some wealth and power. Pottery was imported from the Argolid, Attica, and Aigina – in the last case the cooking pots, some with potters' marks, which were still circulating in palatial times. In the industrial area of IB, a large fragment of a Cypriot copper oxhide ingot was found, and also of Cypriot origin or inspiration, a piece of a ceramic wall bracket from building IΔ of a type known from Tiryns, and from the same context a coarseware stirrup jar marked in a Cypriot fashion.

Kanakia is best interpreted as the seat of a local ruler well connected to Mycenaean political and economic networks; with probably fine harbors, it must have been a destination for maritime traffic in the Saronic Gulf. Salamis was a busy place in LH IIIA–IIIB, with a large number of settlements and cemeteries that have not been adequately investigated (Anastasiou-Alexopoulou 2003). In the early twelfth century, Salamis was apparently a destination for refugees

of the palatial collapse and Kanakia may have been one of several sites on the island to receive them until circa 1150, when it was finally abandoned.

Ayios Konstantinos is a small village of the Mycenaean palatial period, situated on a high ridge overlooking the southeastern coast of the Methana peninsula. Unlike Kanakia, the settlement had no easy access to the sea, and so probably supported an agropastoral community exploiting terrestrial resources and routes. Yet among its humble buildings it housed a remarkable sanctuary, important for numerous reasons: its inconspicuous position within a simple village; the in situ condition of the remains, which permits chronology and ritual performance to be reconstituted; and the distinctiveness of the cult objects, which show local variability that cannot be characterized as a chronological effect (Hamilakis 2003; Hamilakis and Konsolaki 2004; Konsolaki-Yiannopoulou 1999, 2001, 2002, 2003b). The cult centered on the small Room A (4.3 × 2.6 meters), whose furnishings consisted of a floor of mixed earth and pebbles, a stepped bench in the northwest corner opposite the entrance, a low platform along the south wall, a podium in the center of the room, and a hearth in the southeast corner (Fig. 7.12). The finds date the use of the room to LH IIIA–LH IIIB. On and around the bench, excavators found more than 150 terracotta figurines, tripod altar tables, pottery, and a triton shell similar to those found in Minoan shrines. The corpus of figurines is unusual in that it consists mainly of bovids (cattle and oxen) and horses, with several rare groups including horses with helmeted riders, horses with chariot groups, and ridden and yoked oxen. The standard Mycenaean female figurines that are so abundant elsewhere are virtually absent. Other aspects of the sanctuary are well attested elsewhere, however. Like most Mycenaean cult places outside the palaces, this sanctuary lacks monumental construction or decorative elaboration. The pottery includes kylikes, bowls, alabastra, and rhyta, all common ritual shapes. Certain structural features, a stepped bench on which figurines were displayed, and platforms on the wall opposite the bench and in the center of the room, probably served as attention-focusing devices in the rituals and connect this sanctuary with others such as the Temple in the Cult Centre at Mycenae. Of utmost significance is the hearth, which was filled with ash and animal bones as well as scattered sherds from tripod cooking pots. Analysis of the faunal remains revealed a predominance of burnt juvenile pig bones, with lesser representation of sheep and goat (Hamilakis 2003; Hamilakis and Konsolaki 2004). The presence of all body parts suggests that these animals were burnt offerings (holocausts) to the deity rather than meals roasted for human consumption. The destruction of the entire animal body is perhaps to be understood in terms of the symbolic consumption of the offering by the deity (Hamilakis and Konsolaki 2004: 145). This is the first evidence found in a primary use context for burnt animal offerings in Mycenaean Greece, although the practice of animal sacrifice followed by human consumption was certainly widespread (Hamilakis and Konsolaki 2004: 144).



7.12 Partial plan of excavated Mycenaean structures, Ayios Konstantinos, Methana, with Room A indicated. Konsolaki-Yiannopoulou 2002: 26, fig. 1. Courtesy of the Swedish Institute at Athens.

In such close quarters, the performance of ritual at Ayios Konstantinos may have created an embodied sensory experience of food, drink, music (the triton shell used as a horn), and symbolic communication with deities and ancestors through the sights and smells of burnt offerings (Hamilakis and Konsolaki 2004: 146–47).

The anomalous features at Ayios Konstantinos are difficult to assess, since we possess few Mycenaean sanctuaries and thus do not know the true range of variation. We do not know whether the sanctuary was autonomous, serving

the needs of a small rural community, or tethered to a regional center, such as Megali Magoula (Konsolaki-Yiannopoulou 1999, 2003b). Ayios Konstantinos may have been like one of the outlying communities to which the palaces sent animals for sacrifices and feasting, as attested in the Linear B archives at Pylos and interpreted from a large deposit of animal bones and tableware at Tsoungiza (Bennet 2001: 33; Dabney et al. 2004).

Kolonna itself was occupied throughout the Mycenaean palatial period, as we know from pottery and burials, but there is little architecture that can be definitively attributed to LH IIIA–IIIB, and the surviving material is sufficiently meager that the continuing status of Kolonna as a center of major political and economic importance is in doubt. There are mitigating circumstances, however. The necropolis on nearby Windmill Hill indicates a sizable population, and extensive leveling in the Archaic and Hellenistic periods has obliterated at least some of the earlier architectural complexes. Remains of buildings and terraces underneath later structures, exposed in recent excavations in the West Complex and the south slope, may be part of the "missing" fourteenth to thirteenth century center (Felten 2007: 18–19; Felten et al. 2008). The ceramic material and the tombs demonstrate that Kolonna had been incorporated into the Mycenaean koiné, while imports from Cyprus and the southeastern Aegean show that Kolonna remained connected to regional and interregional maritime trade.

Elsewhere on Aigina, there are ample signs that influences from the Argolid were pervasive in the palatial period. The later sanctuary of Aphaia in the northeastern corner of the island was possibly an open-air hill sanctuary already in the LBA (Pilafidis-Williams 1998). The presence of standard terracotta human and animal figurines implies the adoption of Mycenaean cult practices. Neutron activation analyses carried out on sherds and figurine fragments from the site identified an origin in the Argolid for a high percentage of both groups (Pilafidis-Williams 1998: 166–81). If we combine this evidence with the limited but growing material from Kolonna, a picture emerges of an island thoroughly invested by Mycenaean influences from the Argolid no later than LH IIIA2, and possibly earlier.

The critical juncture at which hegemony in the Saronic passed from Kolonna to Mycenae seems therefore to fall sometime early in LH IIIA, i.e., the first half of the fourteenth century. This has been seen as some form of conflict or competition (Pullen and Tartaron 2007), but the nature of the interaction and resulting transformation is unclear. Was it a violent takeover of territory and trade routes, or was it an evolutionary process in which Mycenae's superior resources and broader networks of relations around the Aegean and beyond gradually rendered Kolonna irrelevant? There is no obvious evidence of destruction at Kolonna in this period, or necessarily of retrenchment; indeed, recent excavations indicate that ". . . the whole enlarged settlement was in use at least until LH IIIB" (Felten 2007: 19). Nor is there much clarity about Mycenae's

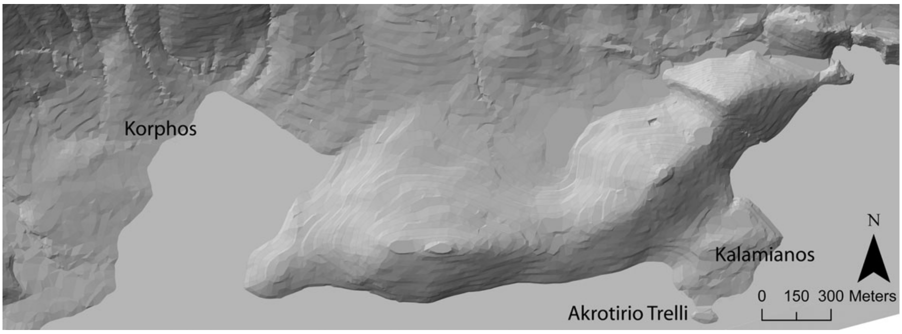
specific endeavors abroad since the early Mycenaean period there is known mainly from burials, and even LH IIIA settlement in and around the citadel is poorly known because of the extensive rebuilding programs in LH IIIB (French et al. 2003; Shelton 2010).

On balance, the second scenario seems more likely and has been offered as a partial explanation for the emergence of Mycenae to prominence in the Argolid (Voutsaki 1995, 1998, 1999, 2001). Sofia Voutsaki (1999: 113–14) makes a compelling case that Mycenae outmaneuvered Argive rivals such as Lerna and Asine to forge strong ties with partners on Aigina, the Cyclades, Kythera, and Crete. This network of alliances, giving access to exotic goods and raw material wealth – displayed or fashioned into high-status items deposited ultimately in monumental tombs – allowed elites at Mycenae to differentiate themselves from their counterparts in the Argolid and to position themselves, in social network terms, to accumulate ties preferentially and thus to suppress competition. As mentioned above, a similar scenario has been proposed with Kolonna as the dominant node in the Saronic Gulf, and Kolonna may even have played a role in suppressing the emergence of a palace state in the Corinthia (Pullen and Tartaron 2007: 157). Nevertheless, groups in the Argolid at Asine, Argos, Midea/Dendra, Tiryns, and elsewhere continued to bury exotic items and other forms of wealth with their dead at least through LH IIIA, before the concentration of wealth in burials was increasingly restricted to Mycenae in LH IIIB (Burns 2010: 168–90).

Thus, we can establish the likelihood, but not the certainty, that it was Mycenae that carved out maritime networks in the Saronic Gulf before LH IIIB. Given this ambiguity, it is the smaller settlements located in between Kolonna and Mycenae, such as Megali Magoula, with material spanning LH IIB–LH IIIA, and the later foundations at Kanakia and Ayios Konstantinos, through which we witness the gradual transfer of the Saronic region from the Aiginetan to the Mycenaean sphere of influence. The last location considered in this case study, the coastal site of Korphos-Kalamianos, presents another perspective on the Bronze Age Saronic maritime small world as a settlement that alternated over time between prominence and insignificance, between high and low connectedness. A consideration of this settlement from the dawn of the Bronze Age to the end of the Mycenaean palatial period will help to round out our diachronic narrative.

Korphos-Kalamianos and the Saronic Small World

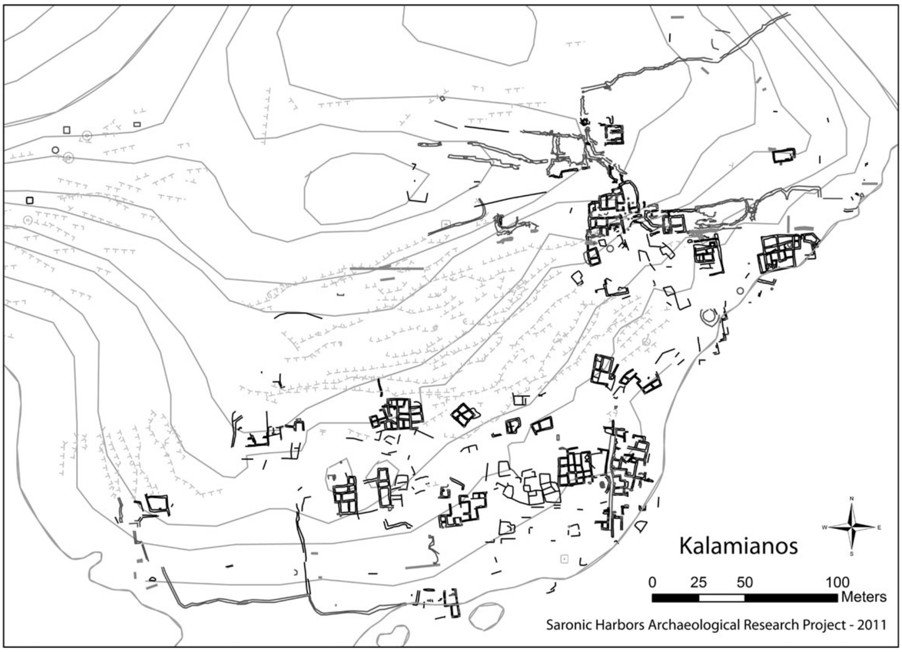
In 2001, members of the Eastern Korinthia Archaeological Survey (EKAS) discovered a large Mycenaean architectural complex at the location *Kalamianos* near the village of Korphos, on the rugged Saronic coast of the southeastern Corinthia (Fig. 7.13; Rothaus et al. 2003; Tartaron et al. 2003). The importance of the site was instantly clear: walls and foundations of buildings of Mycenaean



7.13 Digital terrain model of the Korphos region.

type, some of them monumental, are exposed on the surface of the gentle seaside slope above the cape known as *Akrotirio Trelli*, covering almost eight hectares on land and an unknown further extent now submerged underwater (Fig. 7.14). In 2006, the Saronic Harbors Archaeological Research Project (SHARP), which I co-direct with Daniel J. Pullen, was constituted for the purpose of initiating investigations on the site and in its surroundings.[5] From 2007 to 2009, a first phase of surface investigations was carried out, comprising detailed mapping and architectural study, a surface survey on the site and in a zone of seven square kilometers around it, geomorphological and environmental research, initial underwater investigations, the recording of oral histories, and various

7.14 Aerial photograph of the Kalamianos site. Balloon photograph by Kostas Xenikakis and Symeon Gesafides.



7.15 GIS plan of architecture and other features at Kalamianos. Photo by author.

specialist studies of the artifacts collected by the survey. (For a detailed preliminary report, see Tartaron et al. 2011.) SHARP hopes to undertake excavations at Kalamianos at a future date.

The site consists of an urban settlement preserved as stone architectural foundations and walls occupying approximately 4.5 hectares set within a town wall enclosing around eight hectares (Fig. 7.15). The "empty" 3.5 hectares seem to have been used for agricultural terraces and to quarry the settlement's building stone. Because of a unique convergence of tectonic activity, erosion, and human history, these features are exposed on the surface, giving us a rare opportunity to study a virtually complete Mycenaean settlement. The buildings employ a characteristic Mycenaean large-stone and -rubble construction, with foundations and walls preserved in situ, surrounded by massive stone collapse that indicates the considerable height of the original walls (Fig. 7.16). To date we have recorded over 1,200 walls and more than 50 buildings.

Although Kalamianos witnessed human activity at detectable levels during much of the Bronze Age, the urban settlement was a new foundation, laid out with a strong measure of central planning in a short period of time beginning around 1300 BC or a little earlier. Most buildings are oriented roughly to the cardinal directions, with long axes either north–south or east–west. Yet neither the layout nor the buildings themselves are uniform across the site. In certain areas, multiroom buildings cluster to form complexes, whereas elsewhere buildings are free-standing and often set at a distance from one another. Moreover, some

of the buildings can be described as monumental while others are more modest in size and architectural elaboration. These contrasts suggest some form of differentiation that may be social, functional, chronological, or some combination thereof.

The chronology of the Kalamianos site was firmly established by a gridded intensive surface survey. Artifacts and features were recorded in regular 25 × 25 meter grids, and special collections were made from the interior spaces and rubble cores of intact buildings. The canonical masonry of the walls provides a rough chronology in the palatial period (circa 1400–1200 BC), but the retrieval of LH IIIB pottery built into the cores of the walls of many buildings provides a *terminus post quem* that indicates a construction date in the thirteenth century. A preliminary analysis of the pottery collected at Kalamianos shows how dominant Mycenaean material is relative to all other periods. If we remove the unidentifiable sherds, LBA makes up 86% with Late Roman coming in a distant second at 5.5%. Also significant is the fact that we have not yet recognized LH IIIC material, meaning that Kalamianos was likely abandoned by around 1200, and so may be closely tied to the palaces and their fate. Postabandonment phases from LH IIIC through Hellenistic are virtually absent.

Geomorphology of an Unlikely Harbor

We have strong evidence that Kalamianos was a harbor settlement in the Mycenaean palatial period, and we have come to believe that it served as Mycenae's principal Saronic harbor in the thirteenth century. Yet we could never have imagined making such bold statements upon first encountering the site. Kalamianos is by no means an obvious location for an ancient harbor: a shallowly submerged peninsula off the coast makes it impossible for even small boats to avoid the shoals and approach the shore today. We approached the Korphos region as most observers would (e.g., Conlin 1999: 77), assuming that if an ancient harbor were to be found, it would be located in the sheltered, inviting Korphos Bay (Fig. 7.13), but Kalamianos provides a perfect illustration of the point, emphasized in Chapter 5, that we cannot assume that ancient Aegean coastlines possessed the same configurations as their modern counterparts.

The modern coastline in the Korphos region is rugged, dominated by a rocky shoreline that plunges to water depths of three or more meters, with the exception of Korphos Bay. Despite its rugged structure, the Saronic coast offers an abundance of small, sheltered anchorages. This was surely true in ancient times as well, but the configuration of the shoreline has changed dramatically since the Bronze Age due to tectonic displacements. In the Corinthia, tectonic movements have occurred along several major regional extensional fault systems with a complex history of differential fault motions. In low-lying, shallow water contexts like Kalamianos, these forces can bring about significant changes in coastal configuration with even small changes in relative sea level. The narrow

7.16 Example of large-rubble construction of Mycenaean buildings at Kalamianos. Photo by author.

land shelf at Kalamianos slopes gently into the shallow offshore waters, with depths of only several meters within 125 meters of the shoreline, after which the sea floor drops abruptly to 50 meters, and within 500 meters from shore reaches more than 100 meters depth. This feature is known to local fisherman as the "chasm," and is exploited as a particularly fertile fishing ground that has sustained the fishing trade for generations.

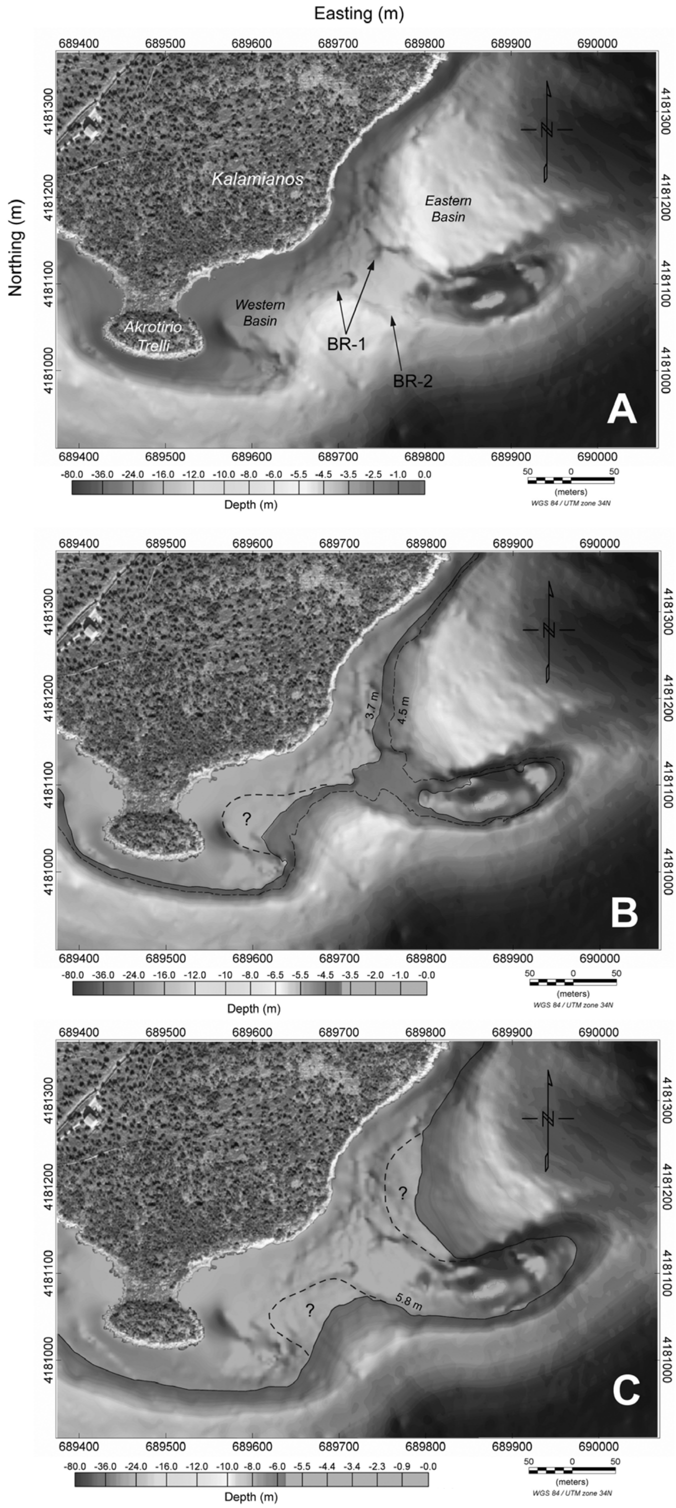
We have followed multiple lines of geomorphological evidence to reconstruct the coastline and harbor basins of the Bronze Age. Recently, a Canadian-American team collaborating with EKAS determined that the coastline of Korphos Bay, about three kilometers west of Kalamianos and just southwest of Korphos village, has undergone net subsidence during the Holocene as a result of co-seismic fault motion (Nixon et al. 2009). From a series of cores taken in a salt marsh, they identified up to five phases of local coastal subsidence since the mid-Holocene, associated with seismic events resulting in rapid relative sea-level rise. The transgressive events were recognized by shifts in the abundance of microfossils (foraminifera, thecamoebians) in marsh sediments and correlated with tidal notches in the inshore area. They estimate a relative sea-level rise of about four meters in the last 5,500 years. Members of the same team recognized several beachrock platforms at depths up to 5.9 meters in the inshore areas adjacent to Kalamianos (Rothaus et al. 2003; Nixon et al. 2009). These cemented

beach deposits were formed in the supratidal zone close to sea level and provide a useful indicator of former sea level (Kelletat 2006; Vousdoukas et al. 2007). In spite of the proximity of these two locations, their tectonic histories are not identical; Nixon and colleagues report that Korphos Bay and Kalamianos have distinct and independent sequences controlled by different fault blocks (Nixon et al. 2009: 51–52). This result illustrates how localized tectonic effects can be, with serious implications for coastline reconstruction, while the shared indications of multiple subsidence events support the archaeological evidence of submerged Bronze Age structures and artifacts off the coast at Kalamianos.

The next step toward identifying the configuration of the Bronze Age coastline and harbor basin was taken in 2009, when a collaborative project was initiated between the Canadian Institute in Greece and the Greek Ephorate of Underwater Antiquities (Enalion).[6] More than 400 line kilometers of bathymetry, side-scan sonar, sub-bottom seismic, and magnetic survey data were acquired within a ten-square-kilometer expanse of sea in the Korphos region using a seven-meter Zodiac inflatable survey boat. The bathymetric survey generated a detailed map of the sea-bed relief around the site, and determined the location and configuration of beachrock ridges identified by previous work, which were then mapped using Differential Global Positioning System (DGPS) equipment. The sub-bottom seismic and magnetic survey data provided information on sediment thickness, bedrock structure, and location of buried ballast and pottery materials within the harbor basin. Underwater diver surveys were conducted using scuba equipment to investigate the submerged beachrock platforms and other targets identified by the geophysical survey. These were documented with underwater video and samples were obtained at several locations for ongoing laboratory analysis (grain size, micropalaeontology, pottery studies) and AMS radiocarbon dating of shell materials.

Results

Based on the results of these studies, Joseph Boyce has constructed a preliminary model of the evolving Bronze Age paleoshoreline configuration (Fig. 7.17). The bathymetry clearly identifies a submerged bedrock promontory extending east from Akrotirio Trelli and a drowned isthmus that formerly connected the small islet with the mainland coast. The submerged isthmus divides the inshore area into two separate lagoonal basins (the "western" and "eastern" basins in Fig. 7.17a). Two distinct beachrock platforms (BR-1, BR-2) appear in the bathymetry mapping and were confirmed by diver survey. BR-1 consists of two mound-like beachrock outcrops located on the submerged isthmus, about 100 meters from shore. The mounds are up to 1.2 meters in height, 30 to 40 meters in length, and about 20 meters in width. Both outcrops are elongated roughly parallel with the modern shore and have a basal water depth of 3.2 to 3.6 meters. Cemented into the calcarenite of BR-1 are thousands of Mycenaean sherds, constituting

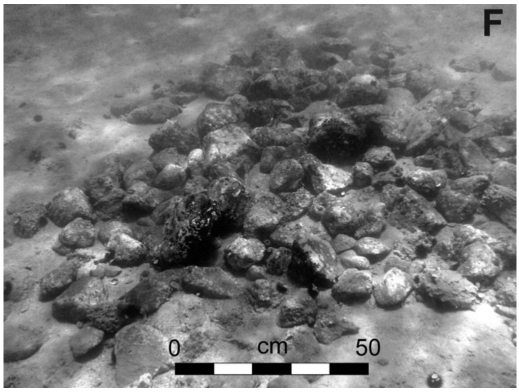


7.17 Reconstructed coastlines and harbor basins at Kalamianos. Courtesy of Joseph I. Boyce, Despina Koutsoumba, and the Trustees of the American School of Classical Studies at Athens.

around 30% to 50% of the beachrock volume and showing little sign of post-depositional reworking or biological alteration. This condition is consistent with rapid burial, as with a tectonic event, in a supratidal low-energy beach environment. The lowermost beachrock platform (BR-2) occurs at a depth of 5.4 to 5.8 meters on the western margin of the submerged promontory. The beachrock is about 0.4 to 0.6 meters in height and incorporates well-preserved sherds of EH pottery making up 10% to 20% of the beachrock volume. This pottery also preserves surface decorative features and lacks significant post-depositional reworking or biological alteration, consistent with rapid burial. Because beachrock forms at the interface of shore and sea, and because the Aegean is nearly tideless, we know that at one time BR-1 and BR-2 were shoreline positions. The pottery cemented into the platforms gives *terminus post quem* dates for the formation of the beachrock; that is, BR-1 could not have formed prior to the Mycenaean period, and BR-2 must have formed in the EBA or later. Yet because the condition of the pottery suggests rapid burial and not gradual transport or wearing away of surfaces, and because our examination of the potsherds to date indicates segregation of the pottery phases with little mixing of earlier or later material, it is highly likely that the broken sherds were incorporated into the deposits roughly during the time of their use, whether as the refuse of normal harbor activities or the result of a catastrophic tectonic event.

The provisional chronology derived from the associated pottery allows us to assign the BR-1 shoreline to LH III (circa 1400–1200 BC) and the BR-2 shoreline to an EH phase (circa 2700–2200 BC).[7] As reconstructed, during the LH (Mycenaean) phase the islet was much more extensive than at present (approximately 500 square meters) but separate from the mainland. The bedrock promontory on the east side of Akrotirio Trelli would have provided a sheltered anchorage site (western basin) with a deep-water approach, the extent of which is approximate because the thickness of the post-Mycenaean sediment fill has yet to be established in seismic and core data. During the Mycenaean phase, small boats could have been pulled up onto shore, and larger ships may have anchored in the western basin or moored at the offshore island. The process of onloading and offloading may have generated much of the broken pottery preserved in BR-1. The western basin would have provided a sheltered anchorage during periods when the dominant winds were blowing from the north or west to southwest, accounting for most wind patterns throughout the year. During periods when winds were blowing from the east and southeast, the offshore island offered some protection from winds and along with the submerged promontory diminished wave energy, but ships might also anchor off the western side of Akrotirio Trelli.

During the EH phase, the local relative sea level was about 5.4 meters below present and the island was connected to the mainland via an isthmus that stood 1.0 to 1.5 meters above sea level. Together, the island and isthmus formed a natural recurved breakwater about 250 meters long and 40 to 50 meters wide,



7.18 Ballast pile identified in inshore waters at Kalamianos. Courtesy of Joseph I. Boyce, Despina Koutsoumba, and Trustees of the American School of Classical Studies at Athens.

creating a well-protected double harbor configuration with many options for moving watercraft as required by weather conditions and a sufficiently deep approach to permit even the largest seagoing vessel of the day – the Cycladic longboat – to anchor close to shore.

Other important clues to the location of anchorage sites were obtained from the distribution of ships' ballast, which can be detected by a magnetic gradiometer survey even when buried at some depth (Boyce et al. 2009). Magnetic surveys in the eastern and western harbor basins at Kalamianos identified a number of magnetic "hotspots" found by subsequent examination to be associated with accumulations of volcanic ballast stones and pottery, which have a significant induced and remnant magnetization compared to the local limestone bedrock and seafloor sediments. Diver reconnaissance surveys of the western basin identified a number of small ballast stone piles and a large, partially exposed ballast mound consisting mainly of andesitic boulders and limestone cobbles (Fig. 7.18). The exposed portion of the ballast mound is four to five meters in diameter and includes scattered Mycenaean pottery fragments. Mapping the distribution of magnetic anomalies and recording their sources is helping to pinpoint the locations of anchorage sites. An intriguing and possibly telling pattern in the magnetic data shows numerous anomalies all around Kalamianos, but few in Korphos Bay. This pattern seems to confirm that Kalamianos was the area's primary anchorage, and there is some evidence that the modern Korphos Bay may have been primarily a wetland in the Bronze Age.

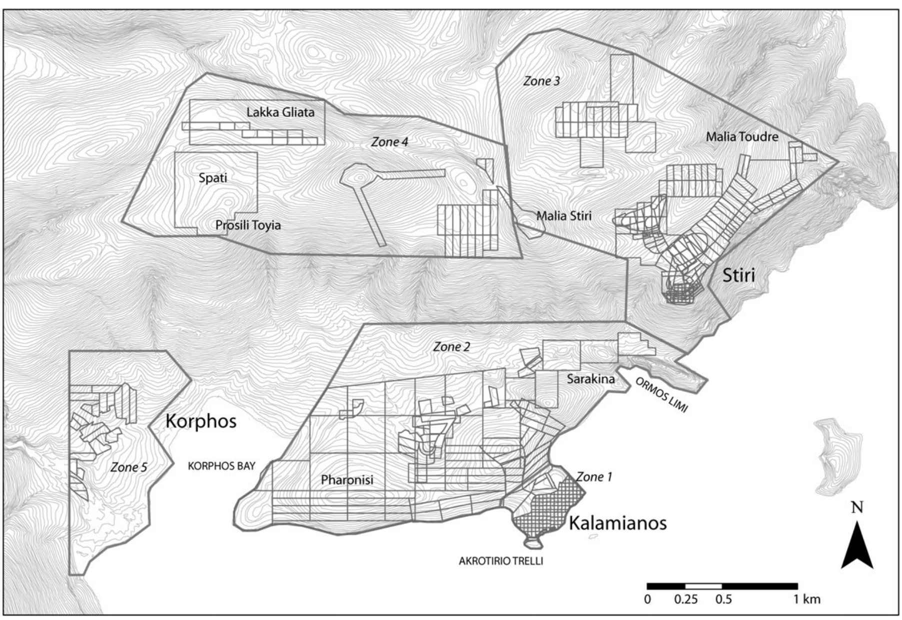
Beyond the Site: Korphos as a Bronze Age Regional Center

SHARP undertook a systematic surface survey of seven square kilometers outside the walls of Kalamianos from 2007 to 2009, using both intensive and extensive methods (Fig. 7.19; Tartaron et al. 2011). The survey aimed to contextualize

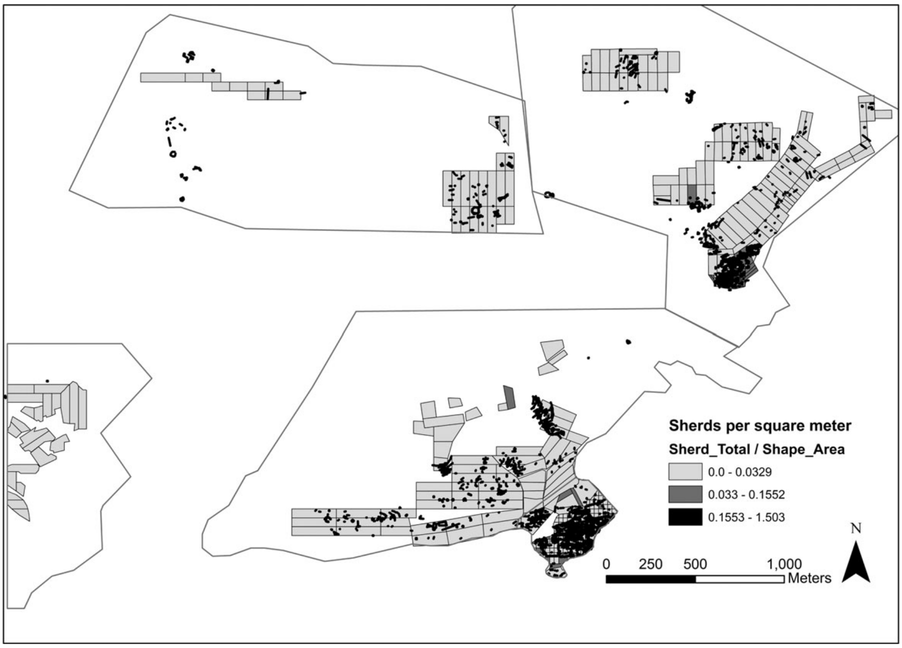
Table 7.2. Classes of EBA and LBA architectural remains in the Korphos region

Early Bronze Age	Quantity	Late Bronze Age	Quantity
Habitation sites (Kalamianos and Stiri)	2	Habitation sites (Kalamianos and Stiri)	2
Stone cairns	Approximately 25	Agricultural terrace walls	Dozens to hundreds of preserved segments
Elliptical stone enclosures	Approximately 20	Fortified stone enclosures	2

Kalamianos in its wider microregional setting, in order to better understand how the harbor town was sustained by and connected to its interior hinterland. We were astonished to discover that the survey area was nearly as rich as Kalamianos itself in ancient architectural remains, similarly exposed on the modern surface (Fig. 7.20). The bulk of this architecture dates either to the EBA or LBA, and we quickly realized that these were the periods in which the Korphos region came to some kind of prominence in the past. Each of these periods is characterized by three kinds of architectural remains (Table 7.2). Taking each in turn, we shall see that there are similarities, but also interesting differences in the locations where people chose to build, and in their overall use of the landscape.



7.19 SHARP survey zones and survey units.



7.20 Ancient architectural remains in the SHARP survey area, marked in black.

Early Bronze Age

The earliest material recovered in survey is pottery belonging to the Final Neolithic/Early Helladic; although it is difficult to be more specific chronologically for unstratified material using only formal criteria, there are reasons to believe that most of these sherds date no earlier than the end of the long FN period or the beginning of EH. Remarkably, the whole range of vessel forms, from tableware to cooking and storage pots, contain inclusions (almost certainly temper) characteristic of the volcanic suite of minerals found on Aigina.[8] The reddish, iron-oxide-rich fabric may derive from local terra rossa clays, tempered with crushed volcanic rock retrieved from andesite imported from Aigina as raw material or as finished ground stone implements. The appearance of Aiginetan volcanic rock in the Korphos region at this early date is consistent with Curtis Runnels' (1985a) finding that the island exported volcanic millstones by Late Neolithic, and it implies that Aigina was already becoming a center in the Saronic region. Close connections with Aigina already in the EBA are not surprising, since Kolonna and Kalamianos are intervisible sites; indeed, on a clear afternoon it is possible to make out the archaeological site of Kolonna from Kalamianos.

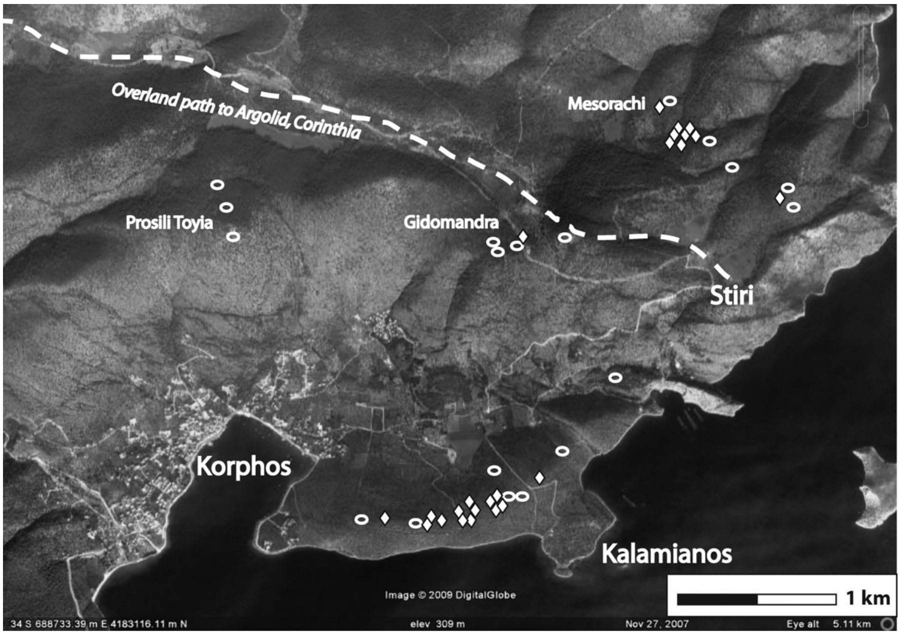
EBA material (architecture, pottery, lithics) is spread throughout the survey area. During the EBA, there were two substantial settlements in the Korphos region: a seaside settlement at Kalamianos – now mostly submerged and without

obvious architectural remains preserved on land – and a quite large settlement at Stiri, perched high above Kalamianos on a coastal bluff (Fig. 7.19). The most striking feature of the poorly preserved settlement at Kalamianos is an obsidian workshop now eroding from gravels near the modern water's edge. All stages of the reduction process, from raw nodules with preserved cortex to finished blades, are present. Inland from Kalamianos, obsidian is ubiquitous, but occurs mainly as finished blades and flakes, although cores and other pieces show that tool making took place on a small scale in many locations.

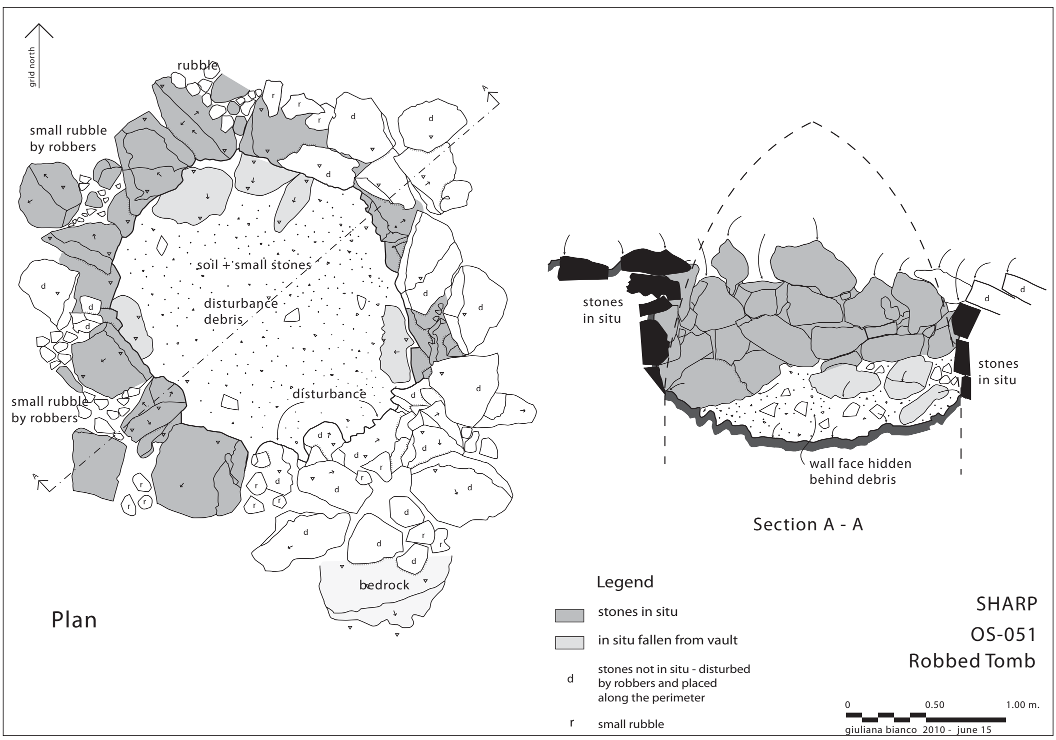
The settlement at Stiri is marked by discrete fields of stone on the sea-facing southern slope, replete with EBA pottery and stone artifacts, which represent the locations of collapsed structures. Several thousand pottery sherds and obsidian flakes and blades were concentrated over an area of approximately four hectares on the peak and surrounding slopes, making Stiri a very substantial settlement for its main period of occupation in EH II. The pottery encompasses a wide range of types and decorative styles, indicating a thriving domestic settlement with local and long-distance trade contacts. Two likely motivations for occupying this location are the vast viewshed over the Saronic Gulf, and ready access to a number of small but well-watered upland basins ideal for small-scale agriculture.

A second architectural manifestation of the EBA comprises about 25 enigmatic cairns – amorphous stone piles distributed both on the ridge of the Pharonisi peninsula north and west of Kalamianos, and in the upland basins to the north (Fig. 7.21). These cairns can be distinguished from modern field clearance piles by their form, erosional features, and artifactual associations. Pottery retrieved from their interiors is of FN–EH II type, with no certain later material. They occur in a larger and a smaller size that seem to relate to different functions. The larger cairns are similar to those we have investigated in the last decade at Vayia and Vassa in the northeastern Peloponnese, where collapsed but partly preserved wall faces suggest an originally squarish, perhaps tower-like form that we interpreted as collapsed bastions in enclosure walls around EH II settlements (Tartaron, Pullen, and Noller 2006). Those cairn groups tend to snake through the landscape, with large cairn mounds connected by wide linear stone piles that we interpreted as walls. There are only two certain cairns of this scale in the survey area, and unlike at Vayia and Vassa, their relationship to known settlements is unclear.

The smaller cairns cannot be interpreted in the same way. They are far more numerous (23 of 25), and their form is more limited to a round or elliptical mound of stone, without radiating linear features. In one of the smaller cairns, illicit digging revealed a cavity or chamber built up in a corbelling technique, which suggests the strong possibility of a burial chamber, though no finds were discovered inside (Fig. 7.22). Despite the differences between the small and large cairns, they share one intriguing feature: most have one or more depressions in their upper surfaces, suggesting a collapsed cavity



7.21 Satellite image with locations of stone cairns (diamonds) and enclosures (ovals). Satellite image © 2009 Google Earth, © 2009, Digital Globe.



7.22 View and drawing of a small cairn on the Pharonisi peninsula. Drawn by Giuliana Bianco.

such as the one revealed illicitly. It is thus possible that all of the cairns are funerary monuments, with simpler and grander versions.

The collapsed cairns of the Korphos region would have been taller than they appear today, and more visible on the landscape locally and from a distance. They were placed in prominent ridge-top locations with expansive viewsheds and high intervisibility with other EBA cairns and enclosures. Typically, they overlooked both the sea and adjacent arable land, suggesting that they were meant to be seen from the sea, and possibly also served as territorial markers manifesting the claims of a living community to land and resources through explicit links of descent from ancestors who occupied them in the past (Murphy 1998; Saxe 1970). Whatever the range of functions, the cairns in the Korphos area can now be associated with at least a regional, and not simply a local, tradition in the northeastern Peloponnese.[9]

The final architectural type comprises approximately 20 walled stone enclosures, found in virtually every part of the survey area, which can now be confidently dated to the EBA on the basis of associated artifacts – we have not recovered later material from the features themselves – as well as geomorphological observations. Though predominantly elliptical in form, they range from round to elliptical to squarish and vary in size from 15 × 12 meters to 25 × 30 meters, translating roughly to between 125 and 700 square meters of internal space (Fig. 7.23). The locations and viewsheds of the enclosures provide the best clues to their functions (Fig. 7.21). Most have excellent views both to the sea and to nearby arable land below them. Almost every enclosure is potentially intervisible with at least one other, and many with several others, although we lack information on vegetation cover and we cannot definitively establish that the enclosures are all contemporary. Yet it appears that they were placed systematically and strategically on the landscape with a carefully rationalized social purpose. Some potential functions include monitoring stations with views to the sea, to agricultural territories, and to an upland basin-to-basin route running west to give access to the interior Corinthia and the Argolid; collection structures for agricultural produce; animal enclosures; territorial markers; or forts or similar defensive complexes. Perhaps they combined all of those functions as the strongholds of extended family or kin groups arrayed across a contested agropastoral landscape. Historical and ethnographic examples of contested landscapes resulting in functionally comparable structures can be found in Greece and the Balkans (e.g., Galaty in press; Galaty, Lee et al. 2009; Karakatsianis 2010; Mangalakova 2004; Wagstaff 1965).

There also seems to be a chronological and conceptual association between the cairns and enclosures. The stone enclosures are closely associated spatially with cairns at several locations, but elsewhere they seem to be isolated or semi-isolated from other architectural complexes. Yet both are embedded in the same webs of intervisibility: cairns are visible from enclosures and vice versa. Most

7.23 View of an EBA stone enclosure.

decisive, however, is the fact that at two or three places, cairns and enclosures are combined into a single feature. Together, these features present a highly humanized, and perhaps competitive, rural landscape in EH II.

The implication of this busy countryside is that the Korphos region was an important EH center, a coastscape interacting with other coastal centers in a period of high connectivity. The importation of Aiginetan andesite and obsidian from Melos, 170 kilometers distant, shows Kalamianos already operating as a major harbor. Whether the obsidian was obtained directly on Melos by Korphiote voyagers, purchased from visiting Cycladic traders, or acquired through Aiginetan intermediaries, the fact remains that Kalamianos is one of relatively few import and primary reduction centers known in the Aegean, joining the list of such sites as Lerna in the Argolid (Hartenberger and Runnels 2001; Runnels 1985b), the Fournoi cluster in the southern Argolid (Kardulias 1999: 64–71; Kardulias and Runnels 1995: 104–108; Van Andel and Runnels 1987: 89–91), and Romanou in Messenia (Parkinson 1999). In the reconstructed EBA coastline, the obsidian workshop lies close to the shore of the western basin.

In EH II, the sequence of corridor houses and other signs of emerging complexity at Kolonna indicate that it continued to be the center of a Saronic small world, with cultural ties, though not yet regular trade relations, with other coastal settlements with fortifications and corridor houses. Kalamianos/Stiri played a significant role in the Saronic small world, though it is difficult to know if labels such as "peer of Kolonna" or "secondary center" are appropriate. The Saronic Gulf was apparently a vibrant place in EH I–II before a precipitous decline sometime in EH III. EH material has been found in almost every

area subjected to excavation or regional survey; perhaps the most compelling demonstration of general vitality emerges from systematic, intensive surveys. The Methana Survey team, though by their own account working in a "rough and rocky place," nevertheless recorded fifty-one sites with EH pottery in the limited confines of the Methana peninsula, roughly evenly divided between EH I and EH II (Mee and Taylor 1997: 42–51). SHARP has located dozens of scatters of EH sherds in its own small survey area, many of these not directly associated with the EH sites or architectural features described above.

The data from SHARP and Methana are again informative about the period of abandonment, or at least retrenchment, between EH III and the end of the MH period. SHARP has produced no certain EH III or MH pottery, with the possible exception of a few sherds with standard Aiginetan potters' marks that may fall sometime in MH I–LH I. On the Methana peninsula, both EH III and MH sherds are rare, though present (Mee and Taylor 1997: 51–52). This is precisely the period in which the vibrant Saronic small world of the EBA collapsed, compelling Kolonna to refocus its energy beyond the Saronic Gulf. That the gulf was not an entirely empty seascape, however, is underscored by the recent discovery on Salamis of a large MH II–III acropolis-type settlement at Sklavos, on the island's southern coast facing Aigina (Lolos 2010). It seems, therefore, that scattered pockets of the Saronic still supported substantial communities, while most places were reduced to tiny hamlets or abandoned altogether.

Late Bronze Age

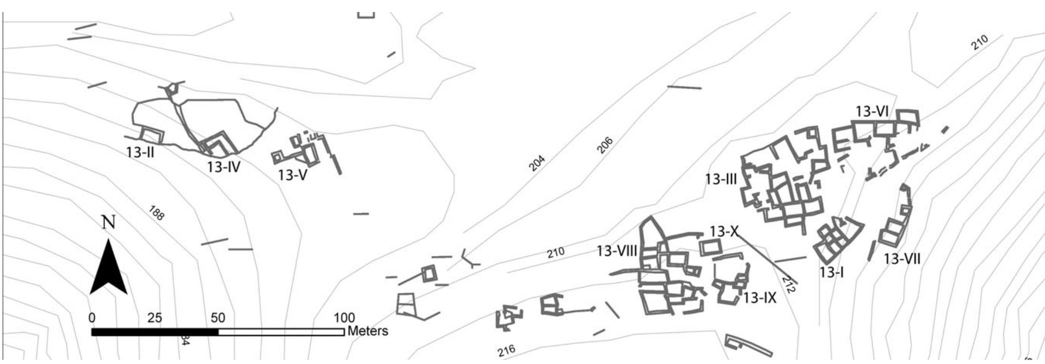
During the LBA, the Mycenaean harbor settlement at Kalamianos was the main, anchoring center of the Korphos region. Pottery recovered at the site indicates that a settlement of modest size had taken root in the fourteenth century – just less than 10% of the LH assemblage at Kalamianos belongs securely to LH IIIA. From this inconspicuous beginning, in the early thirteenth century, i.e., the LH IIIB1 pottery phase, the urban harbor complex was built and became one of the more important sites in the Saronic region. It was also in the thirteenth century that the Mycenaeans developed the hinterland to harness the agricultural and pastoral potential of the lowland and upland zones, in support of Kalamianos' maritime (and perhaps overland) connection to the Mycenaean economy. The physical traces of this expansion include a second substantial settlement built at Stiri over a part of the old EH site, a large fortified enclosure in the territory between Kalamianos and Stiri, and dozens of agricultural terrace walls of Mycenaean date.

The Mycenaean settlement at Stiri sits on a ridge overlooking a double-lobed basin to the west, and the sea to the east and south (Fig. 7.24). As at Kalamianos, the foundations and lower walls of several distinct complexes of well-constructed buildings are exposed on the surface, preserving the plan of the settlement in its apparent entirety (Fig. 7.25). At around 1.4 hectares

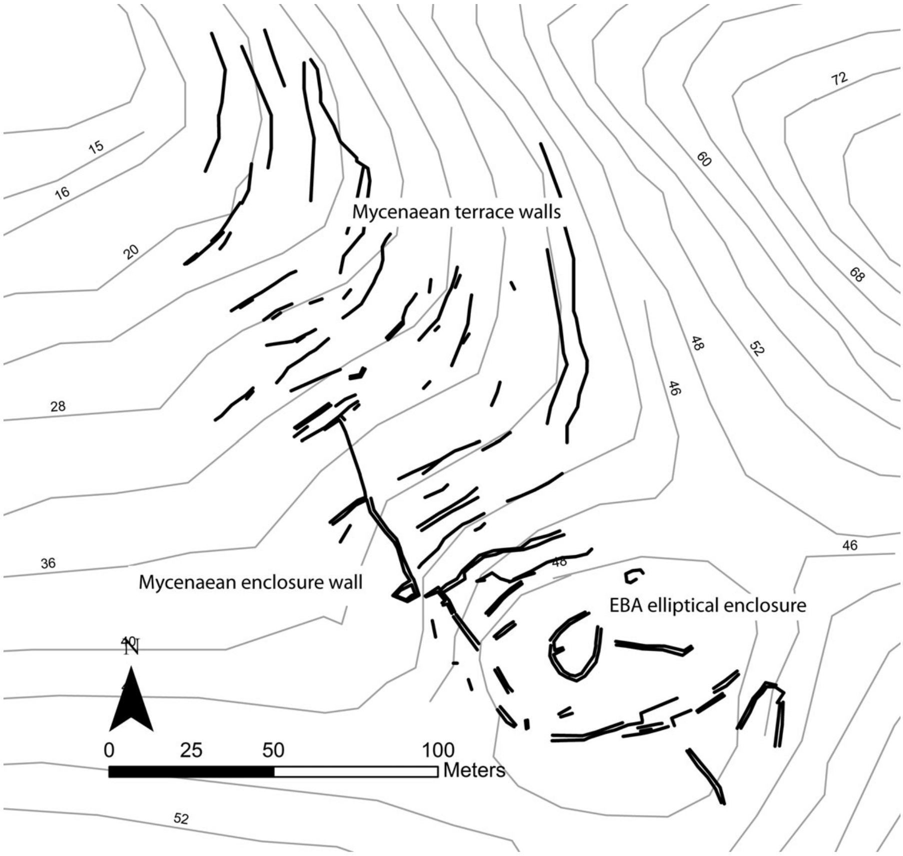
7.24 View of Stiri and adjacent polje, with location of the Mycenaean site indicated.

in extent, Mycenaean Stiri is less than one-fifth the size of Kalamianos. The masonry technique is essentially the same as at Kalamianos, although Stiri lacks the monumentality of some buildings at the harbor site, and the varied building plans do not match those at Kalamianos particularly closely. Yet the buildings are remarkable in their own right, such as the sprawling central structure 13-III that consists of between 35 and 40 rooms. The Mycenaean artifacts recovered within rooms and wall cores belong exclusively to LH IIIB, showing that Stiri was a later foundation than Kalamianos, but also that the two settlements overlap chronologically in that phase.

Location must have been an important factor in the role Stiri played in the Mycenaean coastal world of the thirteenth century BC. Perched on a high sea cliff with an unobstructed view of Kalamianos, Stiri was undoubtedly in constant communication with the harbor town below. A sweeping viewshed extending from Athens and Salamis in the northeast to Aigina and Methana in the east and southeast allowed the inhabitants to monitor seaborne traffic on the Saronic.



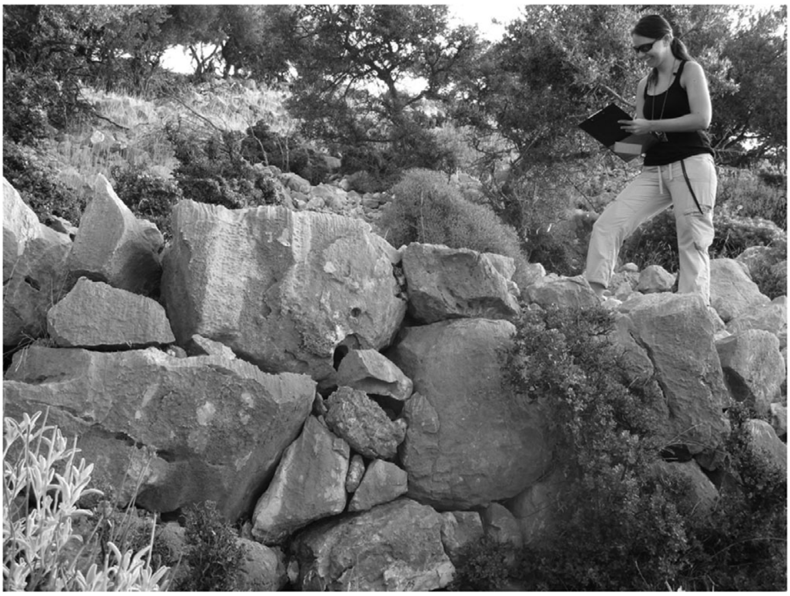
7.25 Differential GPS plan of Mycenaean architecture at Stiri.



7.26 Plan of architectural features at the "saddle site" north of Kalamianos.

A second important function is suggested by the basin west of the site, which is well watered by springs and winter rains, making agriculture and pastoralism possible on a relatively large scale. Intensive cultivation of wheat and olives has been practiced here in recent times, along with grazing of sheep and goats on wheat stubble and in the wooded hills all around. This productive landscape may have been systematically developed to provide staple crops, animals and their secondary products, and trade goods to the harbor community at Kalamianos.

In the sloping terrain between Kalamianos and Stiri, a large Mycenaean walled enclosure was situated in a saddle between two low peaks immediately north of Kalamianos, consisting of a large space enclosed by partially preserved fortification-grade walls that can be traced for about 180 meters (Fig. 7.26). Within the presumed interior, there are many terrace walls of Mycenaean type on the north slope facing a large basin that may have been another locus of agricultural activity. Also preserved inside the fortified area is one of the elliptical stone enclosures of EBA date. To the south, the sea view is limited, but the harbor at Kalamianos is plainly visible. This site may have been the



7.27 Monumental Mycenaean agricultural terrace walls at Stiri.

agricultural estate of a high-status family or individual, connected closely with the settlement at Kalamianos and perhaps with elite families there.

In the territories adjacent to the two main settlement sites, the Mycenaeans invested heavily in terrace wall construction, apparently to maximize agricultural potential in this stony, semi-arid landscape. The terrace walls are the subject of a recent dissertation by Lynne Kvapil, whose important contribution has been to systematize the documentation and dating of terraces throughout the study area (Kvapil 2012). Systems of terracing dating to the Mycenaean period have been found at Kalamianos itself, on the western slopes of the hill north of Kalamianos, on the south-facing slope of the Pharonisi peninsula, in the saddle area described above, and on the steep south slope below Stiri. At Stiri in particular, the slope facing the sea was terraced with massive walls in Mycenaean masonry technique, sections of which survive on contours from top to bottom (Fig. 7.27). One aspect of their construction that ties them closely to Mycenaean architectural practice is the use of stones with flat outer faces and long, triangular trailing edges that help to bond the wall with the terrace behind it. This technique is also clearly seen in wall building at the two settlement sites. The southern slope at Stiri is the steepest on which the Mycenaeans built terraces, partially explaining their monumentality, but just as important was their prominent visibility from the sea. As at Kalamianos, monumentality and high visibility seem to have been as integral to the design of the built environment as their utilitarian function. Although there were several basins suitable for agricultural exploitation in both the lowland and upland zones, it seems that

the Mycenaeans felt the need to maximize agricultural yields to support the population of this microregion and perhaps to generate a surplus for shipment from the harbor at Kalamianos.

Comparing Early and Late Bronze Age Exploitation

There are similarities, but also important differences, in EH and LH patterns of activity in the Korphos region. The Mycenaean inhabitants occupied Kalamianos and Stiri as their primary settlements, as had their counterparts in EH. These locations make sense as the lowland and upland anchors of the region, giving access to the sea at Kalamianos and agropastoral resources as well as panoramic viewsheds at Stiri. In LH IIIB, Kalamianos was a much larger and more important settlement than Stiri, while in the EBA the relationship was reversed. Mycenaean habitation at Stiri was confined primarily to the ridge top; the steep south-facing slope was apparently used only for agricultural purposes as many segments of strongly built terrace walls survive but counts of LBA artifacts are quite low.

Beyond the two main settlement sites, the differences in the distribution of remains and use of the landscape are striking. The most distinctive difference is that EBA activity, measured both by architecture and portable artifacts, was much more extensive throughout the survey area, while the Mycenaean activity pattern was more spatially limited, focused on the habitation sites and their immediate surroundings. A likely explanation for this difference is that EBA activity was the result of a long development, begun already in FN, and thus a "settling into" the landscape. Depending on how far back into FN the activity began (and this we do not know at present), a period of a millennium or more is indicated to the end of EH II. The EBA signature developed over a relatively long period of gestation leading to a flourishing and complex society in EH II.

The Mycenaean distribution, on the other hand, reflects a deliberate but short-lived transformation of physical and social landscapes in which emigrants, most likely from Mycenae, arrived in the late fourteenth century to a sparsely populated area, built a harbor at Kalamianos, and developed the hinterland to support it. The identification of Mycenae as colonizer of Kalamianos rests on circumstantial evidence, which taken together presents an argument that we have found persuasive, if not yet conclusive. It is perhaps most accurate to say that the evidence draws us to the Argolid, with Mycenae consistently the most plausible option. The Mycenaean fineware collected from Kalamianos and Stiri exhibits general affinities with the Argolid, while the architecture offers compelling parallels in construction techniques and monumentality (Tartaron et al. 2011). The large-rubble construction of buildings at Kalamianos can be classified as Type III cyclopean masonry in Claire Loader's (1999: 27–31) typology, characteristic of the Argolid and other Mycenaean core areas. The Mycenaean

agricultural terrace walls, particularly at Stiri, show strong similarities to those in the vicinity of Mycenae itself. It is also possible to make a case that Kalamianos was the most conveniently located anchorage offering Mycenae access to the Saronic Gulf, Attica, and the Isthmus of Corinth, particularly since the evidence of Mycenae's presence in the northern Corinthia is slim (Pullen and Tartaron 2007; Tartaron 2010). There is a modern land route beginning at Korphos or Stiri, which follows a series of interconnected east- to west-trending basins and passes through Angelokastro and Limnes, before joining the Mycenaean road at Berbati to finally reach Mycenae after a journey of approximately 50 kilometers on foot. This route is attested by villagers in the Korphos/Sophiko area, and members of SHARP have made the walk on several occasions in a single day, requiring between nine and thirteen hours depending on fitness. It is by no means an easy walk, but even making allowances for ancient tracks rather than modern roads, a two-day journey with a donkey would not have been difficult.

Mycenae's interest beyond the connectivity offered by the maritime station was agricultural intensification in small pockets of fertility, while the upland zone also monitored the sea and connected the region to routes leading to the interior of the Corinthia and the Argolid. The timeframe of their arrival in the late fourteenth or beginning of the thirteenth century, as suggested by the ceramic evidence, coincides with the explosion of sites with Mycenaean characteristics on the islands and shores of the Saronic (see Fig. 7.10). By the late fourteenth century, the penetration of Mycenaean material culture was profound, encompassing not only styles of architecture and pottery, but also burial and cult practices, including the objects that accompanied them – such as the ubiquitous anthropomorphic and zoomorphic figurines that might betoken the propagation of a state religion.

Mycenae's presence in the Korphos region was intense but brief, lasting perhaps only 100 or 125 years, before the abandonment of the region circa 1200 BC, roughly synchronous with the collapse of the palace state at Mycenae. The brevity of Mycenae's presence precluded expansion into all niches in the landscape as a normal consequence of development and growth. However, the substance and monumentality of the Mycenaean constructions suggests that they were built for permanence, and surely long-term growth was expected before it was truncated by the collapse of the palaces.

Korphos and the Saronic World through Time

The results of SHARP's field studies permit the outlines of a diachronic narrative for the Korphos region to be interwoven with that of Kolonna and other communities to develop a larger history of the Saronic maritime small world.

Sometime before the beginning of the third millennium BC, potters in the Korphos area were importing Aiginetan volcanic stone, which they crushed and

used as temper in the full range of functional pottery classes. Incipient settlement in the SHARP survey zone in FN/EH I grew steadily, culminating in a highly developed economic and social exploitation of the landscape in EH II. During that phase, raw obsidian was imported from Melos and worked into tools at a workshop overlooking the western basin of the harbor at Kalamianos. Stiri was a large settlement well situated for agropastoral subsistence and for expansive views over the Saronic Gulf. The pottery assemblage at Stiri represents a full domestic suite, and shows that the inhabitants were connected to sources of contemporary shapes and decorative styles. The Korphos region can thus be counted among the nucleated and socially complex coastal centers of the EH II Aegean. At that time, Kolonna, with its large settlement and two phases of a grand corridor house, was the most important settlement in the Saronic and well along its trajectory toward regional domination. This was a period of cohesion in the Saronic small world as settlements in places like Kalamianos, Kiapha Thiti, and the Methana peninsula interacted with Aigina, and, although it is nearly impossible to prove, surely with neighboring small settlements as well.

From EH III to the beginning of the Mycenaean palatial period, Kalamianos is almost invisible archaeologically, like so many other small settlements of the northeastern Peloponnese. This hiatus lasted even longer than for the many communities that were founded or revitalized in MH III or LH I. The scant evidence of human presence, consisting of a few sherds at Kalamianos with standard Aiginetan potmarks, is insufficient to project more than a sparse, inward-focused population engaged in agropastoral pursuits, with limited external contacts between 2200 and 1400 BC. This dramatic depopulation prevailed throughout the Saronic, with the principal exception of Kolonna, which exploded into complexity with continuous expansion of the settlement, characterized by massive building programs of fortifications and dwellings. Kolonnans now developed long-distance contacts with Minoan Crete, the Cycladic islands, central Greece, and the interior Peloponnese, in part to compensate for the deep reduction in connectivity within the Saronic Gulf. They imported pottery and may have hosted a small enclave of Minoan potters, but soon Aiginetan potters developed their own highly successful export industry that persisted well into the Mycenaean palatial period, and for specific shapes even to its very end.

The recolonization of the northeastern Peloponnese and the lands bordering the Saronic in MH III–LH I, and the events of the Shaft Grave Era in the Argolid, seem to have drawn Kolonna's attention back to the Saronic Gulf. The earliest phases of the LBA marked a time of prosperity and high connectivity between Aigina and the settlements on the islands and coasts of the Saronic, along with more distant partners in Attica, the northeastern Peloponnese, central Greece, and the Aegean Islands. Mycenaeans from the Argolid expanded their interests and exports only gradually into the Saronic region. Mycenaean-style painted pottery of LH I–IIA is rare in the circum-Saronic area. The Saronic

small world, although nested geographically within the Helladic realm, may have been culturally distinct from the emerging Mycenaean palatial state in the Argolid, and seems to have resisted its expansion into the Saronic Gulf. By LH IIB, when Mycenaean fineware pottery had begun to appear around the Saronic, the inhabitants of Megali Magoula in the Troizenia were building tholos tombs, perhaps signaling the establishment of a Mycenaean foothold on the western shores of the Saronic. During the crucial transition to early LH IIIA, Kalamianos was part of a contested periphery – the setting for a competitive process in which Mycenae extended its sphere of influence into the Saronic Gulf at the expense of Aigina. The foundation of a number of centers large and small in LH IIIA, such as Kanakia and Ayios Konstantinos, coincided with the decline of the Aiginetan pottery export industry and the adoption of Mycenaean cult practices at Aphaia.

The founding of a port town at Kalamianos, probably by Mycenae circa 1300 BC or slightly earlier, served two objectives: first it was a foothold and safe haven for maritime economic and military activity in the Saronic, and second it was a definitive statement of Mycenae's ascendancy. This statement is encoded in the monumentality of the architecture at Kalamianos and the terrace walls at Stiri, quite remarkable in contrast to other Saronic settlements of the period, marking Kalamianos as a second-order center and probably Mycenae's principal Saronic harbor. This display of power was probably not specifically aimed at Aigina, since Kolonna by that time was no longer a legitimate threat. Instead, it was a characteristic habit of the Mycenaeans of the Argolid to build monumental structures as an advertisement of power, from the shaft graves and tholos tombs to the fortification walls and elaborate buildings on their citadels. The imposing architecture at Kalamianos and Stiri was meant to be seen from the sea.

Kalamianos was a coastscape and the anchor of a maritime microregion characterized by highly developed internal organization, which was at the same time the creation of the wider Mycenaean world, to which it was closely connected by both sea and land. The Korphos region was developed to support the role of Kalamianos as a working harbor town, giving rise to a second substantial settlement at Stiri and a system of agricultural terracing. Kalamianos was not a long-lived settlement, however. The rapid and intensive development of this microregion ceased abruptly circa 1200 BC, when Kalamianos and the other sites were abandoned, suggesting a strong association with the fate of the palaces and many other settlements that were destroyed or abandoned at that time.

Oral History and Kalamianos

In the absence of written records in prehistory, different forms of ethnographic and ethnoarchaeological research can contribute to enlightening hypotheses about the conditions of seafaring and the social and economic networks that

prevailed in ancient small worlds. Members of SHARP were fortunate to be able to interview elder residents of Korphos, who described details of life in the village in the years during and before World War II, when there were no paved roads to Korphos and no motorized seacraft, yet the Saronic Gulf was teeming with social and economic activity. Lita Tzortzopoulou-Gregory conducted a program of interviews between May 2007 and June 2009, which I have mined for the observations that follow.[10] Of particular relevance to the topic of this chapter are the relationships that the inhabitants of Korphos maintained with the inland village of Sophiko on the one hand, and the coasts and islands of the Saronic on the other.

Prior to the Second World War, Korphos was a fishing and seafaring village, with perhaps 90% of the male population engaged in fishing or merchant activities on the Saronic Gulf. Young boys learned by doing, taking to the boats at a young age to accompany their fathers and grandfathers on their rounds. The more ambitious or better connected aspired to be sea traders because there was good money in it. The fishermen were generally poor, as fish were plentiful and cheap throughout the Gulf. Their work provided subsistence and fish to exchange with farmers, shepherds, and forest workers for needed commodities. There were approximately 30 families living in Korphos, each owning at least one fishing boat or caique. As many as 60 rowboats, fishing boats, caiques, and small sailing boats were anchored at Korphos. Most of the boats were built at Perama on Salamis island.

The consensus among the seagoing Korphiotes is that the Saronic is a relatively trouble-free body of water to navigate. They use the word *limni* (lake) to describe it, asserting that the winds and currents are not especially dangerous, and the shallows and other hazards are few. This is not to say that environmental conditions had little effect on voyages. One experienced seaman reported that the trip from Korphos to Aigina in a small sailing boat could take anywhere from three to seven hours, depending on the winds. On longer trips, the merchants would overnight at ports of call in their boats before setting off for home the next morning; they generally did not travel on the Saronic at night.

The fishermen worked in local waters and preferred the fishing ground between Kalamianos and the small island of Ayios Petros offshore. It was there that the shallow waters off Kalamianos gave way to the steep drop-off of the sea bed, known locally as the "chasm," where the catch was plentiful. The fishermen rarely ventured more than a few kilometers from Korphos. In winter, fishing continued but kept close to shore. In addition to subsistence use, fish and seafood were transported by donkey to Sophiko, a trip of approximately one and a half hours by an old path that followed a stream bed west of town to the upland basins that open west to the interior Corinthia. One older woman remembers bartering for goods with Sophiko residents who did not have cash to pay for the fish.

Korphos was, in the early twentieth century, a *proti skala*, a major port in the Saronic trade, and this afforded the sea traders a more varied life, intimately connected with both inland producers and the merchants at ports and anchorages around the Saronic. Farmers and herders from Sophiko village owned most of the land in the hinterland of Korphos, and they engaged in several traditional pursuits. Farmers grew cereals, chiefly wheat but also barley, and tended olives, mainly for their own subsistence needs with the surplus traded in Korphos and elsewhere. Wheat and barley were also grown in the limited lowland basins, including the one directly above the Kalamianos site. Sheep and goat were herded in the upland areas and their primary and secondary products were offered in trade for maritime products and services. The most prevalent occupation in the upland zones around Korphos, however, was forest work. Wood, charcoal (mainly from bushes and bush roots), and pine resin were harvested in this heavily forested region and brought on donkeys to Korphos for shipment abroad. The sea traders purchased these varied products and exported them to Saronic markets, either in their own boats or in larger ships they contracted for the purpose. It was not only at Korphos that these products were collected for shipment. Often, when a farmer's fields or trees were closer to one of the many tiny anchorages in the area, the produce would be brought down and picked up there. One resident reported that the sea traders often took advantage of the inland producers who were dependent on sea transport by bargaining for unfairly low prices.

There was not a single dominant port in the Saronic, but instead a handful of large, bustling nodes of maritime connectivity. Several interviewees recalled bringing wood, charcoal, resin, and manure to markets at Piraeus, Eleusis, Salamis, Aigina, Poros, Nea Epidauros, and elsewhere. Frequently, a port town specialized in processing certain material or had high demand for specific products. At Eleusis there were factories processing resin, while charcoal and wood were in demand at all of the above-named ports. In exchange, the Korphiotes sought food and staples. From Aigina they imported flour and water jugs (even in modern times tempered with the volcanic inclusions that enhanced their performance), fruits and vegetables from Nea Epidauros, and foodstuffs and water from Piraeus, among many other items. On returning to Korphos, the merchants brought their wares to Sophiko and sometimes beyond, where local buyers acquired them and distributed them further on. The forest industries have long since become economically unprofitable. There are few uses for charcoal,[11] and pine resin, once used in turpentine and other chemical products, has been superseded by synthetic substitutes, while the popularity of resinated wine has declined in recent years. A few farmers continue to harvest resin on a small scale.

Fresh water was and remains scarce in the village, and this was perhaps a strong incentive for Bronze Age people to settle at Kalamianos instead. Water was

retrieved from coastal sites such as Nea Epidauros, Kyra island, and occasionally Kenchreai. One informant describes four men regularly taking a four-meter-long rowboat to Nea Epidauros to fill 150-kilogram barrels with water, taking turns rowing one and a half hours each way. Tiny Kyra island, several kilometers off Kalamianos, had a fine though not copious spring where fishermen would often fill up. In the years after World War II, small boats brought water daily from Piraeus or Salamis as part of government programs. Fetching water by boat was a summer activity, since cisterns in the village filled amply with winter rains. Women and girls traveled by boat or donkey to Kalamianos to wash clothing in two brackish wells there.

Some of the more intrepid seafarers ventured outside the Saronic, one mentioning that he had sailed out to islands such as Siros, and along the eastern Peloponnesian coast. We might think of these as the modern counterparts of the "expert" sailors discussed in previous chapters. Many Korphiotes spent some part of their adult life in the merchant marine, aboard big ships engaged in international commerce. They all returned to the village and their families after several years at sea.

Kinship relations with Sophiko were close, and there was much intermarriage. People also found spouses in Aigina and Salamis; many Korphiotes emigrated to Salamis and Aigina after marriage. This is one demonstration that social imperatives such as maintaining genetic and demographic viability bound together coastal communities in a small world. Another example is that children from Korphos, Nea Epidauros, and other coastal villages were sent to Aigina for high school because these small communities could support nothing more than a one-room elementary school. The notion presented in Chapter 5 that the landward limits of the coastscape were generally the passes and the first-encountered inland nodes finds support in the movements of the Korphiote merchants, as well as the fact that there was little interaction with Corinth before the modern road was built to join the Corinth–Epidauros coastal highway in the 1960s.

When prompted concerning the general orientation of the community, the informants were unanimous that the Korphiotes have always thought of themselves as an island people: they looked to the sea for their livelihood, wore island dress, listened to island music and danced island dances, and created networks of interaction with coastal and island people in the Saronic. They contrasted their outlook with that of the Sophikites, whom they considered inland, "mountain" people. That they nevertheless maintained close social and economic ties with Sophiko indicates the dual orientation of a maritime coastal community, and exemplifies the inland–coastal symbiosis that is an important feature of the dynamism of coastal life. Perhaps the coastal–inland symbiosis between Korphos and Sophiko in modern times is analogous to the relationship between Kalamianos and Stiri in the LBA. Several interviewees spoke of a pre-modern switchback walking path from the lowland north of Kalamianos up

the steep slope to Stiri, used to access the eleventh-century church of Panayia Stiris; thus, although the two sites seem mutually inaccessible, people on foot with their donkeys have managed to overcome an environmental obstacle to preserve connectivity in this microregion.

The Korphos–Sophiko system in the early modern period bears the stamp of a microregion in Horden and Purcell's terms, and Korphos emerges as a coastscape and a maritime coastal community. The people of Korphos forged the link between the terrestrial and maritime worlds and facilitated the exchange of desired commodities. The sea merchants truly occupied a position of centrality with respect to connectivity around the Saronic. Young boys were inculcated in the seafaring life and the essential knowledge was passed down within families, much as we have seen among South Pacific societies. In the first half of the twentieth century, the Saronic Gulf was a vibrant modern small world, with a proliferation of nodes on coasts and islands and innumerable crisscrossing paths connecting them.

What use are these oral histories to us as we contemplate life in the coastscapes of the Mycenaean period? With the customary caution against equating modern times with eras of the remote past, it is possible to suggest that the challenges and opportunities encountered by these two peoples inhabiting a Saronic small world bear many similarities. The traditional lifeways of early twentieth-century people and their Mycenaean counterparts in the Korphos region were not qualitatively dissimilar; they possessed comparable technologies of subsistence and seafaring. They lived at times of modest prosperity and vigorous interaction, when both were highly connected to spheres of interaction on land and sea. Much will have been different, of course; to name just one example, the structures of political power are not comparable. Nevertheless, the information we obtained from local residents tends to support the picture I have constructed from archaeological and ethnographic data, and therefore it seems appropriate to add it to the diverse strands of evidence bearing on the reconstruction of Mycenaean coastal worlds. The theoretical underpinnings of this position rest in a structure–contingency framework (Bintliff 1999; Tartaron 2005: 158–59): essentially, there are long-term structures, corresponding in *annales* terms to the forces of the *longue durée* that influence the configuration of societies and their interactions with the world around them. Among the most important are the environment (including physical geology and geography, climate, and resources) and the human subsistence technologies (agropastoral, maritime) and other adaptive mechanisms (culture) that allow populations to survive and sometimes thrive over time. By establishing structural similarities between two societies or periods, it is acceptable to take the comparisons further, but this may not be done by ignoring the differences, which may reside already in the structural realm but are most salient in medium-term political and economic patterns (*conjonctures*) and in decisive events (*événements*). It is in the

interplay of long-term forces with shorter temporal and smaller spatial contexts that historical contingency arises, giving each locality and community a unique history. My contention is not that we can simply equate the Korphiotes of the early twentieth century with their counterparts at Kalamianos in the LBA. Rather, given key structural similarities of environment, technology, and location in the Saronic Gulf, their respective engagements and worldviews on facing the sea – their connectivity and interaction patterns – may also share important parallels, at least hypothetically as we await future phases of investigation.

Discussion

When considered in terms of a maritime cultural landscape framework, we observe the fluctuation of the Bronze Age Saronic maritime small world between cohesion and fragmentation, as demographic patterns and external opportunities drew Aigina's attention into and away from the Gulf. The hegemony of Aigina in this small world, at least economically, seems to have begun already in the later Neolithic. From there, the Saronic maritime small world developed steadily to a peak in EH II, collapsed from EH III to MH III, revived in the Shaft Grave Era to reach a second peak in LH I–II, until finally (though gradually) Mycenae usurped Kolonna's traditional role. For the coastal communities dotting the coasts and islands of the Saronic Gulf, this transformation entailed not only a new master, but new cultural material and practices, and a reorientation of maritime relations and connections. In effecting this transformation, Mycenae broke apart the old Saronic world and incorporated the region into a larger world of land and sea connections.

I hope to have made a few central points in this extended case study by interweaving the stories of Kolonna and Kalamianos, ones that can be applied usefully to other cases. The Saronic was susceptible to the emergence of maritime small worlds because visual contact, relative ease of movement by sea, and moderate distances facilitated connectivity and the experiential sense of a coherent world. Taking a bottom-up perspective, we can propose that this is important because most Mycenaeans lived and died mostly or wholly within these small-scale settings. For more than a millennium, Kolonna, with a fortunate location and important natural resources, established itself as a center interacting with small peripheral settlements in the Saronic as well as more distant trading partners. But precisely because small worlds are nested in larger-scale spheres of influence and respond to the consequences of external developments, they are prone to change over time. The Middle Helladic hiatus shows that, as Horden and Purcell emphasized, social forces often trump environmental imperatives; we cannot simply map maritime relations according to currents, winds, and distances.

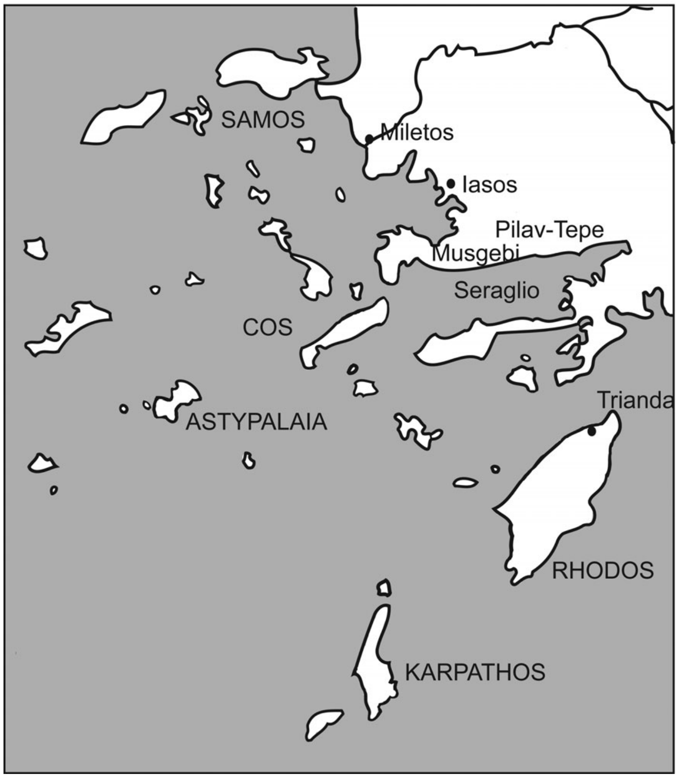
By following Kolonna and Kalamianos, we see the Saronic small world responding both to internal dynamics and to shifting centers of power and demographic trends played out beyond the Saronic. Kalamianos became prominent only in periods of strong supra-local connectivity: EH II with its nucleation of population and strong maritime orientation, and LH III with the incorporation of large territories by the Mycenaean palaces. In each case, the harbor at Kalamianos and its hinterland were developed to articulate with economic and political systems of greater scope than the Saronic. If we break down these broad patterns, we could write a different history for each coastscape, reflecting varied effects of, and responses to, dynamics both internal and external to the Saronic. The story of Kalamianos is different from those of Megali Magoula, Kiapha Thiti, or the Salaminian settlements at Kanakia and Sklavos, nuancing but not diminishing the validity of the broad diachronic and spatial patterns. The same dynamism pertains to the shape and extent of the regional/intracultural sphere over time. The changing distribution of Aiginetan pottery (excepting rare distant outliers) is a useful measure of Kolonna's regional sphere of interaction in a given phase (Fig. 7.7).

Tracking the long-term history of the Saronic leads to the realization that Kolonna and Mycenae exercised very different styles of center–periphery leadership. The evidence from Kalamianos and other sites suggests that when the Mycenaeans infiltrated the western shores of the Saronic, they colonized, built massively, developed local economies, and in some cases extended a measure of political control. By comparison, the Saronic small world of the Aiginetans seems decidedly underdeveloped. Certainly, Kolonna exercised economic hegemony, benefiting from control over trade in the Saronic and extending its export networks to the nearby mainland and islands. Yet one looks in vain for sites with monumental Aiginetan-style architecture, or other signs of intensive political or economic development of the Saronic. As such, the coastscapes of the Saronic were not exactly like the peraia of later times (Constantakopoulou 2007; Horden and Purcell 2000: 133), because the elements of political control and direct economic exploitation from the island state that seem to have been essential in the Classical period were lacking.

In attempting to understand the coastscape at Kalamianos and its role in the Saronic small world, the ability to reconstruct the Bronze Age coastline was decisive, and this will be true also in the two brief case studies to which I now turn.

Potential Coastscapes and Small Worlds: Miletos and Dimini

In this concluding section, I offer brief outlines of two additional places where there is high potential for identification of coastscapes and small worlds. These

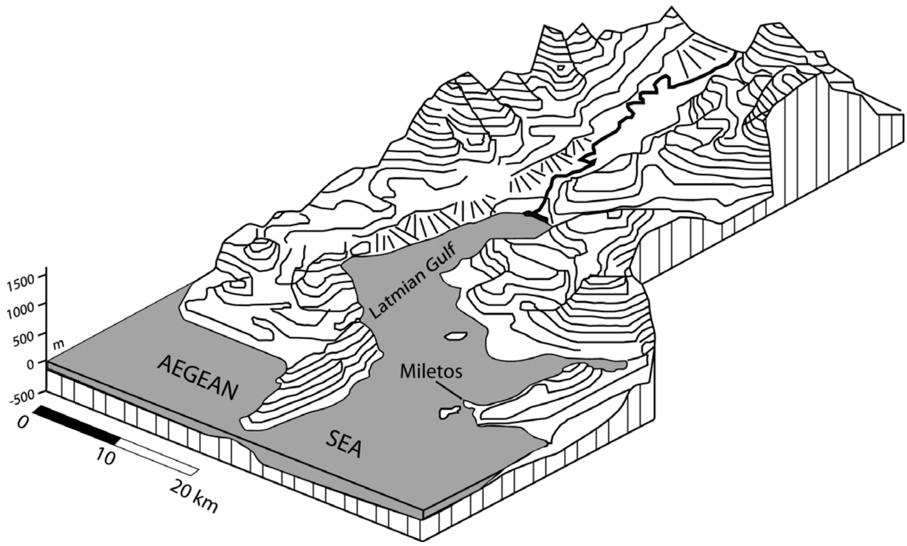


7.28 Map of the southeastern Aegean and southwestern Anatolian coast. Drawing by Felice Ford.

observations on Miletos and the Latmian Gulf, and Dimini and the Bay of Volos, are not detailed analyses, but rather explorations of ways that a maritime cultural landscape perspective might be illuminating in understanding the Mycenaean-period activity in these coastal settings. The main principle guiding the selection was that reasonable amounts of both archaeological and paleocoastal information should exist.

Miletos and the Latmian Gulf

The former Latmian Gulf (now virtually closed) is a striking example of a deep marine embayment created by flooding of a low-lying coastal shelf during the pan-Mediterranean Holocene marine transgression (Figs. 7.28, 7.29). At the peak of the transgression circa 6000 to 5000 BP, the gulf may have extended 40 to 50 kilometers inland, but there is some evidence that relative sea level was actually highest circa 2500 BC (Bay and Schröder n.d.; Brückner 2003; Herda et al. 2009; Knipping et al. 2008; Müllenhoff et al. 2005). At the termination of the marine transgression, the process of infilling of the gulf by delta progradation of the Maeander (Menderes) River began, assisted by the instability



7.29 Three-dimensional map of the Latmian Gulf at maximum marine transgression, circa 4000 BP. After Bay and Schröder n.d., fig 3.

of the natural Mediterranean environment and augmented by variable long-term human impacts. A German geoarchaeological team placed more than 100 sediment cores in the Maeander floodplain in order to reconstruct the advancing coastline in the context of human activity (e.g., Brückner 2003: 121–27). Using methods similar to those described in Chapter 5, they relied mainly on macro- and microfaunal analysis to determine diverse environments of deposition (marine, littoral, lacustrine, terrestrial). Radiocarbon dating of organic material furnished a chronological framework, which was supplemented by archaeological and historical information.

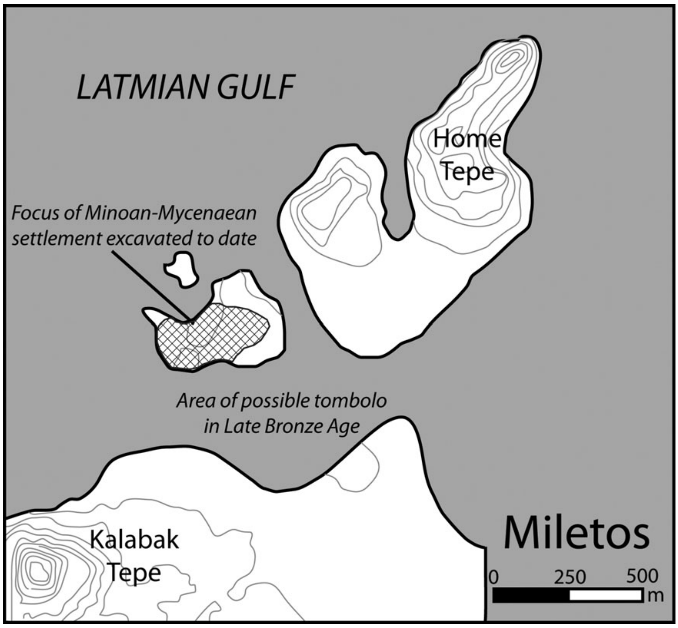
The progradation of the shoreline toward the Aegean was gradual through the Bronze Age, though a modest increase in sediment load can be attributed to the erosional effects of expanded goat herding in the second millennium BC (Knipping et al. 2008: 368, table 1). A rapid and massive increase in the rate of sedimentation occurred only in the first millennium BC (Bay and Schröder n.d., figs. 4, 5). During the Mycenaean period, the gulf still penetrated some 30 kilometers inland, and the promontory of Miletos consisted of two main islands, one formed by Home Tepe and Kale Tepe and the other the area of the later temple of Athena, which may or may not have been connected to the mainland by a tombolo (Brückner 2003: 129–30); in short, Miletos was part of an archipelago-like coastal landscape facing onto a still-vast Latmian Gulf (Fig. 7.30).[12] All around the islands and coastal areas there will have been natural anchorages and small coastal plains suitable for habitation. The climate was favorable, with moderate temperatures and adequate rainfall to support agriculture. Other natural resources such as timber and building stone were

plentiful (Greaves 2002: 8–16). The Maeander valley was also a communication corridor connecting the sea with east–west land routes to the interior. Along those routes metals and other products from the interior of Anatolia may have been passed along to the Aegean (Greaves 2002: 32–37).

Sporadic German excavations since the beginning of the twentieth century have demonstrated that the LBA at Miletos witnessed first intensive Minoan, then Mycenaean, influence (Niemeier 1998, 2005). Early excavations established three LBA "building periods," essentially confirmed by more recent campaigns. The first building period corresponds to Minoan presence in Miletos phase IV, succeeded by Mycenaeans in the second (Miletos V) and third (Miletos VI) building phases.

Miletos V encompasses pottery phases LH IIIA1–2, from the late fifteenth to the end of the fourteenth century. Wolf-Dietrich Niemeier (1998, 2003, 2005) makes a strong case that in the second building period, there already was a Mycenaean colony at Miletos. The architectural remains are meager, and two rectilinear buildings in the Athena temple area may or may not show Mycenaean influence (Niemeier 1998: 30–31). But in other ways, the settlement is overwhelmingly Mycenaean. The pottery – including painted fineware, unpainted, and domestic coarseware – is predominantly Mycenaean with virtually no indigenous Anatolian types. Seven kilns from this period are known, including mainland Greek and Cretan types, establishing Miletos as an important center of pottery production (Niemeier 1999). Slight evidence exists for cult activity in the form of a terracotta phi-type figurine (Niemeier 1998: 33). No cemetery associated with the settlement is known. The second building period ended in a destruction dated by pottery to the LH IIIA2/IIIB1 transition, which has been linked to the Hittite conquest of Millawanda circa 1315 BC (Niemeier 1998: 38). As we have seen, scholarly opinion increasingly endorses the equations Ahhiyawa = Mycenaean Greeks and Millawanda = Miletos. Millawanda was a foothold for the kingdom of Ahhiyawa on the western coast of Asia Minor, and Miletos is far and away the most likely candidate for Millawanda, linguistically and archaeologically.

After the destruction of Miletos V and possible control by the Hittites for some period of time, the settlement regained its Mycenaean character in the thirteenth century. The third building period, Miletos VI, has yielded LH IIIB–LH IIIC pottery in large quantities, much of it locally made. Although the architectural remains have been mostly obliterated by later construction, one corridor-type building similar to thirteenth-century examples at Mycenaean mainland centers is partially preserved. A cemetery at Değirmentepe, 1.5 kilometers southwest of the Athena temple, can now be associated with Miletos VI. It includes 11 chamber tombs of canonical Mycenaean type, containing LH IIIB–IIIC pottery and Mycenaean weapons and jewelry. The evidence of cult and administration is again slight: a psi-type figurine and two pithos sherds of local manufacture



7.30 Map showing the topography of Bronze Age Miletos and vicinity. After Brückner 2003: 128, fig. 3.

that may have Linear B signs incised on them (Niemeier 1998: 36–37). The date of the final destruction of Miletos VI has been ambiguous, but the last Mycenaean pottery has recently been placed in transitional LH IIIB/LH IIIC Early or LH IIIC Early, which by comparison with material at Ugarit suggests a date in the neighborhood of 1185 BC, at the time of general unrest in the eastern Mediterranean (Mountjoy 2004).

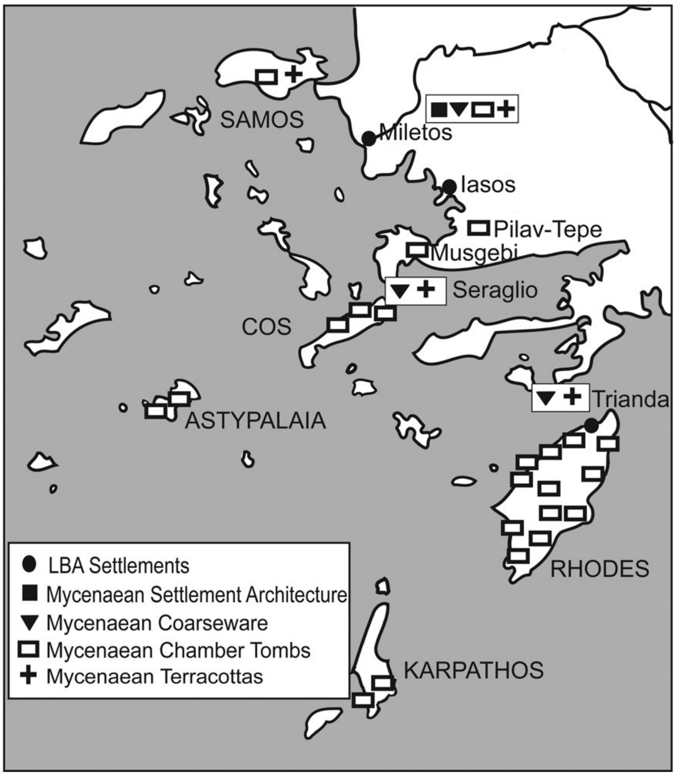
Miletos was unquestionably the most important Mycenaean settlement on the coast of Asia Minor, and there are similarities in its position within the Latmian Gulf to Kolonna's status in the Saronic Gulf at an earlier time. The scale of the two bodies of water is comparable, and the role of intervisibility among the coastal settlements must have been equally important in creating a Latmian maritime small world with numerous coastscapes engaged in dense webs of interactions. Like the Saronic Gulf, the Latmian Gulf is an ideally circumscribed body of water with which to pursue a study of interaction networks at small to medium scale. A similar sentiment is expressed by Nicoletta Momigliano, based on her study of material from Iasos. She characterizes Iasos in the early LBA as a community open to maritime traffic and exchange, but acting only within a regional sphere of interaction in the Aegean; most of the pottery is of Anatolian type while actual imports from Crete, the Cyclades, the Dodecanese, and further afield are rare (Momigliano 2005). She stresses that we should pay more attention to smaller-scale exchange networks and cabotage as the chief mechanism of moving material. (Of course, this is a fundamental theme for

Horden and Purcell, and for the present work.) If sites like Miletos, Trianda, and Seraglio were the emporia of the LBA, Iasos is more representative of the kind of settlement we would expect to find at good anchorages on the shores of the Latmian Gulf.

It is possible to also think about larger-scale interaction spheres into which Miletos was incorporated, thanks to a protracted dialogue among archaeologists, philologists, and historians about the nature and intensity of interactions between the Mycenaeans and the inhabitants of Anatolia's western coast. Long ago, it was noticed that, roughly speaking, the regions south of the Mykale peninsula (i.e., the northern promontory of the Maeander valley) possess a much richer record of contact with the Mycenaean world than those to the north, not only in the quantity of items but also in the presence of material categories that are deemed to reflect actual settlement or some form of engagement well beyond simple trade or episodic visits (e.g., cult objects, burial practices, domestic pottery; Fig. 7.31). The patterns are relatively uncontroversial, but some see colonies or other forms of permanent presence, while others see selective adoption or acculturation. (Compare Mountjoy 1998 and Niemeier 2005 for a sampling of the debate.)

We need not get bogged down in these issues to make the simple suggestion that the zone south of Mykale, termed by Mountjoy (1998: 33, fig. 1) the "Lower East Aegean–West Anatolian Interface," should correspond to the regional/intracultural maritime interaction sphere (see Table 6.1) in which Miletos operated. Mountjoy (1998: 47–51) proposes that this Lower Interface is the kingdom of Ahhiyawa itself. This is another, much more complex, debate beyond the scope of the present discussion (see Niemeier 1998, 2003 for the view that the kingdom of Ahhiyawa must be on the Greek mainland), but certainly the Lower Interface roughly demarcates the network in which familiar cultural materials and information moved with relative ease by sea. In LH IIIC, this zone became the core of the "East Aegean Koine" (excepting Rhodes: Mountjoy 1998: 52–63). For a Mycenaean crew departing Miletos, voyaging beyond the Lower Interface into the Central and Upper Interfaces might have been tantamount to a cross-cultural adventure, though perhaps not particularly daunting to an experienced sailor.

It is difficult to say, in my ignorance of the area, whether a targeted archaeological prospection of the former Latmian Gulf, taking as its starting point the excellent geoarchaeological work, might succeed in populating the LBA small world. Some survey work has been done, but mostly in the vicinity of Miletos itself (Lohmann 1995, 1997, 1999) and mainly with an interest in the historical periods (but see Marchese 1986). Colluvial and alluvial deposits will have buried many early sites (Greaves 2002: 40), but it is also true that Mycenaean artifacts are found on hills and in the hinterland away from Miletos, not restricted to the coast as in the period of Minoan presence (Greaves 2002: 56). It may be

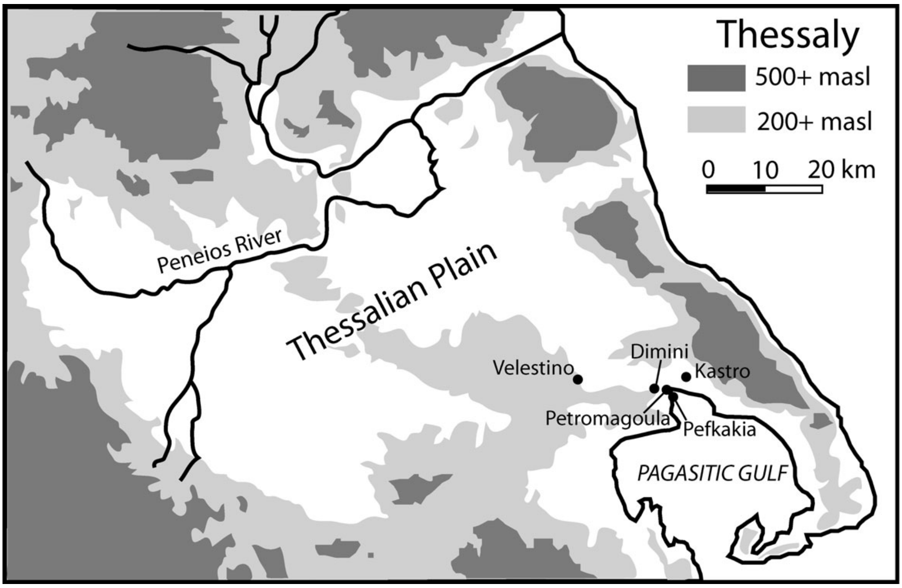


7.31 Mycenaean elements in the southeastern Aegean. Drawing by Felice Ford, after Niemeier 2003: 103, fig. 1.

interesting to attempt an investigation of some part of the lower Maeander valley from a Maritime Cultural Landscape perspective.

Dimini and the Bay of Volos

The Bay of Volos, on the Aegean coast of Thessaly, presents another attractive setting for Mycenaean coastal activity (Fig. 7.32). Well sheltered by its position deep within the Pagasitic Gulf, the bay was the gateway from the sea to the rich Thessalian plain, already the destination of the earliest agropastoralists of the Greek Neolithic. Paleocoastal reconstruction of the bay shows that following the maximum marine transgression circa 6000 BP, at which time the sea penetrated three kilometers inland of its modern position, a series of human impacts and natural sedimentation processes caused the shore to prograde rapidly, so that by the EBA, the coastline had moved 1.5 to 2.0 kilometers seaward (Fig. 7.33; Zangger 1991). The location of the shoreline in the LBA is not known precisely, but it likely averaged two kilometers from the maximum marine transgression, or a little more than one kilometer inland from the modern coast. In addition to abundant arable and pasture land nearby, coastal dwellers could exploit

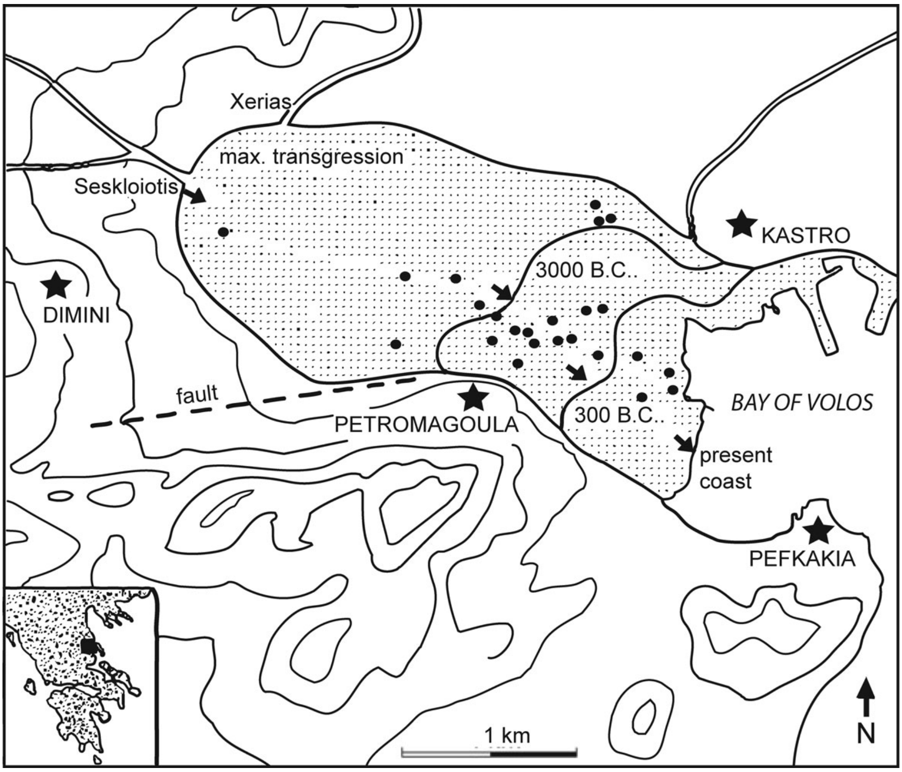


7.32 Area map of Thessaly, with important Neolithic and Bronze Age sites indicated. After Andreou et al. 2001: 261, fig. 1.

marine resources and trade for timber and other forest products from the Pindos mountains.

Ringing the LBA Bay of Volos were a small number of large, nucleated settlements, most prominently Dimini, Kastro (Volos), and Pefkakia. By that time, Dimini was a little more than 2.5 kilometers from the bay, but Kastro and Pefkakia had always been and remained coastal sites. Each of these sites was inhabited through much of the Bronze Age, rarely with a hiatus or a shift in settlement location. Intrasite complexity was well established at the beginning of the Mycenaean palatial period, expressed in the construction of LH II–IIIA tholos tombs near Dimini and Kastro, and built chamber tombs at Pefkakia.[13] Thus, by LH IIIA, one group in society built monumental structures and buried their dead in monumental tombs, while others lived and died more simply. All three sites suffered major destructions at the end of LH IIIB2; Dimini was reoccupied on a small scale in the beginning of LH IIIC, but by the end of LH IIIC Early was abandoned. Only Kastro persisted through LH IIIC and into Protogeometric and Geometric times (Batziou-Efstathiou 2003).

Thessaly is usually considered a periphery of the Mycenaean world, in spite of a large number of sites, both on the coast and in the interior, that were heavily Mycenaeanized. Bryan Feuer (1983, 1994, 1999, 2003) has modeled Thessaly as a periphery exhibiting decreasing integration with the Mycenaean world as one moves from the coast to the interior, in three zones that he terms the "inner border" (i.e., the coastal zone), the "outer border," and the "frontier" (e.g., Feuer 1999: fig. 5). Based on this pattern, Nikolas Papadimitriou (2008)



7.33 Map of the changing coastline of the Bay of Volos. Drawing by Felice Ford, after Zangger 1991: 3, fig. 1.

characterizes Thessaly as both center and periphery. Adrimi-Sismani (2007) argues, however, that the entire region should be considered a fully integrated part of the Mycenaean world, having in common with it settlement patterns, intrasite settlement structure, tomb types, cult practices, pottery and other material culture, and a similar historical trajectory. For the coastal area, at least, this claim has merit and continuing discoveries tend to support it.

Much of Adrimi-Sismani's case rests on her excavations at the remarkable site of Dimini. She has touted Dimini as a Mycenaean palace center, probably the Iolkos of Homer and the saga of Jason and the Argonauts (Adrimi-Sismani 2006, 2007). Excavations from 1977 to 1997 revealed a Mycenaean settlement of around 10 hectares founded east of the Neolithic mound at the end of the fifteenth century (Adrimi-Sismani 1994, 1999, 2006, 2007). The site has two main architectural phases, in LH IIIA and LH IIIB. The later (thirteenth-century) settlement was divided into an eastern and a western zone by a wide road running north–south (Fig. 7.34). The western zone was an elite, or at least public, sector segregated from humbler domestic dwellings east of the road. The western sector centered on Megaron A and Megaron B, two large megaron-style corridor buildings, defined by Panagiota Pantou (2011: 39) as

structures that comprise " . . . a megaron-type unit flanked on one side by a long corridor and a series of smaller rooms (secondary wing)." These buildings were constructed of rubble stone foundations and mudbrick superstructures. A monumental gateway with three axial columns gave access to a forecourt and then to a peristyle courtyard before the megaron unit could be reached in Megaron A. In the series of small rooms to the south, separated from the megaron unit by a long corridor, evidence was found of food storage and preparation, as well as tools for potting and jewelry manufacture. Here too was found a fragment of a stone weight with a Linear B inscription (Adrimi-Sismani 2007: fig. 15.4). Megaron B was even more interesting, with plentiful evidence for cult activity and feasting (Adrim-Sismani 2007: 165). In the middle of the vestibule at the eastern end of the megaron unit lay an H-shaped altar of clay attached to an elliptical platform and two perforated, triangular mudbricks. A painted mug found in situ in front of the altar suggests the pouring of libations. In three small attached rooms to the south, cups holding the remains of animal bones were recovered. Outside the southern entrance to the large western room of the megaron unit, 16 small Mycenaean clay figurines were found next to a large limestone slab with cavities, suggesting a function as a *kernos* for the placement of cult offerings. The northern auxiliary wing contained many storage, cooking, and serving vessels, and just outside the building middens of animal and fish bones, seashells, and broken pottery may be the refuse of feasts. The two large rooms of the megaron unit were found nearly empty, but considering their size and the finds from adjacent areas, they may have been locations for communal eating and drinking, cult ceremonies, and other kinds of public gatherings (Pantou 2010: 386–87). The evidence from Dimini indicates the existence of an intrasite social hierarchy with two tiers: an elite ruling and priestly caste living in the western sector and burying their dead in two tholos tombs at the site, and a larger group of commoners engaged in agropastoral and craft occupations and burying their dead in modest cist graves (Pantou 2010: 389). Adrimi-Sismani (2007: 167) labels Dimini a palace center and the controlling hub of a regional hierarchy in which Dimini " . . . combines all the features of an administrative, financial, and religious center, and consequently it is the only settlement in Thessaly that clearly displays organization and social elements . . . of a true center."

Leaving aside Dimini's possible mythical connections, not all accept the designation of the Megaron A/Megaron B complex as palatial, or of Dimini as a regionally dominant center. In a thorough and methodical reassessment of the archaeological evidence in the Volos region, Pantou (2010, 2011) has challenged many of Adrimi-Sismani's interpretations. Her disagreements fall in two main areas. First, she asserts that the "palace" at Dimini is not palatial. Although the plans (corridor buildings with megaron units, storage, industrial, and cult areas) and some of the activities (e.g., feasting, cult) carried out in Megara A and

7.34 Architectural plan of LBA Dimini. Drawing by Felice Ford, after Pantou 2010: 388, fig. 5.

B emulate those of the Mycenaean palaces, the materials used (stone socle and mudbrick superstructure), the modest elaboration (e.g., simple plastered floor and walls with some painted colors but no frescoes, no ashlar blocks), and the size (falling into Pascal Darcque's [2005] intermediate, not palatial, category) fall far short of their counterparts at Mycenae, Tiryns, Pylos, and elsewhere. Further, the discovery of part of a stone weight with a Linear B inscription does not constitute evidence for " . . . the presence of an accounting system that monitored the movement of products manufactured in the complex" (Adrimi-Sismani 2007: 168).

Second, Dimini was perhaps not the "administrative, financial, and religious center" of the Volos region. Pantou (2010: 383) finds striking similarities in architecture, burial types, and material culture among the settlements at Dimini, Kastro, and Pefkakia. For example, only minor differences in elaboration and grave furnishings exist when one compares tholoi with tholoi and cist graves with cist graves across the region. A two-tiered social hierarchy of ruling elites and commoners existed at each site, manifest in contrasts of architectural elaboration and burial monuments, but in Pantou's view this did not extend to a regional hierarchy (an opinion already expressed by Andreou et al. 2001: 272–73). Instead, she envisions a stable socioeconomic environment with a heterarchical rather than hierarchical relationship among the sites. Dimini, Kastro, and Pefkakia were independent communities with their own internal hierarchies, but with regard to one another display overlapping, redundant features and functions. The settlements are three to five kilometers apart, intervisible, and unfortified.

They lack smaller satellite settlements. In this the Volos region differs from the inland settlement pattern (the Lake Karla region, Almyros Plain, and Pharsala region), where large settlements are surrounded by satellites, probably small agricultural or pastoral settlements (Adrimi-Sismani 2007: 171–74). The contrast must partly reflect a stronger orientation toward maritime and industrial pursuits at the coast, but Pantou (2010: 386) does caution that systematic, intensive surveys are needed to be sure that small sites have not been missed.

If Pantou's reconstruction of the Volos area without a central-place hierarchy is correct, it may be similar to the situation in the northern Corinthian plain, where Pullen and I have argued for long-term social and economic stability in a heterarchical arrangement of settlements (e.g., Gonia, Perdikaria, Korakou) spaced at regular intervals and exploiting similar resources in a generous environment (Pullen and Tartaron 2007; Pantou [2010: 394] notes the similarity herself). Such a stable milieu may in fact inhibit the emergence of an overarching palace center (Haggis 2002; Pullen and Tartaron 2007: 148). This is in contrast to the Saronic Gulf: although Aiginetan dominance was politically underdeveloped, Kolonna was nevertheless the undisputed central place settlement and economic power driving the maritime small world for a millennium. The Mycenaean features in the Volos region might be explained primarily by acculturation, since there is strong evidence of connections with southern Greece already in the MBA. The reader will recall Maran's argument that by MH II, potters in coastal Thessaly were emulating the shapes and decorative schemes of matt-painted Aiginetan pottery (his "Magnesia polychrome"), and from there the influences traveled along with Thessalian products to the northeastern Aegean islands in MH and early LH (Cultraro 2005; Maran 2007). By the time the Mycenaean palaces emerged in the Peloponnese and Boeotia, an elite familiar with southern materials and practices was in place and eager for practical and symbolic markers of power (Adrimi-Sismani 2010).

These observations help us to better define coastscapes and small worlds in the Volos region and beyond. The Bay of Volos may comprise a series of coastscapes within a small world defined by the Pagasitic Gulf. To the south, the Almyros plain and the western and southern coasts of the Pagasitic Gulf have produced several LH sites and five small tholos tombs in the Pteleos area, despite patchy investigation (Adrimi-Sismani 2007: 173). Even less information is available about the Gulf's eastern promontory. It remains likely, however, that the Bay of Volos, with three major, independent settlements, was the main port area for the Pagasitic Gulf, and Pefkakia may have served as the principal harbor. Heterarchy does not mean simply the absence of hierarchy, however, but the possibility of shifting hierarchies and nonhierarchical configurations over time. Thus, in the Volos region we see that the main settlement at Dimini suffered a hiatus between EH III and MH II; Pefkakia was particularly prosperous and outward looking in the EBA and MBA; tholos tomb use continued in LH IIIB

only at Dimini; and only Kastro survived beyond LH IIIC Early. With these and many more observations on individual site histories we can tease out the subtleties of their interrelationships over time.

Casting an eye beyond the Gulf to the regional scale, the early interactions with the nearby Sporades and the northern Aegean islands as far as Lemnos trace out one part of the regional interaction sphere. Another obvious and important maritime route ran south into the narrow Euboean Gulf, the safer side of Euboea for navigation, giving access to Attica, the Cyclades, and farther on the Saronic Gulf and the eastern Peloponnese. The North Euboean Gulf, with many coastal Mycenaean sites, was surely another small world that would reward investigation (Crielaard 2006; Kramer-Hajos 2008; Nikolopoulos 2003; Van de Moortel and Zahou 2005).

Placing an area like the Bay of Volos in a maritime cultural landscape framework may be simply a matter of posing the question from that point of view. One could systematically gather information on the exploitation of marine resources (e.g., fish and shellfish at Dimini), the physical traces of harbor activities at Pefkakia, the evidence of extralocal contacts in the material culture assemblages (e.g., Aiginetan influence on the MBA pottery repertoire; a Canaanite amphora at Dimini), and compare these across the sites. Were the intervisible communities at Dimini, Kastro, and Pefkakia acting in concert in connecting to networks within and beyond the Pagasitic Gulf, or were they acting independently? Was Pefkakia the main harbor for all three? Returning to the question of surface survey coverage in the region, Pantou (2010: 386) doubts that we understand the nature and degree of integration of the coastal area with the interior because there have not been systematic, intensive surveys. How much would such a survey change the picture we now have of large, solitary coastal settlements articulating with very differently organized habitation and production in the interior? How much could systematic survey add to the more "empty" eastern and western land masses enclosing the Pagasitic Gulf, and how would that change our reconstruction of coastscapes and maritime small worlds in the area? The Pagasitic Gulf is a fascinating case study in the extension of Mycenaean influence along maritime routes, and despite a spate of new discoveries and the extraordinary work at sites like Dimini, there is much more that could be learned with problem-oriented research on maritime networks at the local and small-regional scale.

Conclusion

The aim in presenting one detailed and two brief case studies of Mycenaean maritime worlds has been not only to demonstrate a particular approach, but also to try to convince the reader that this approach offers the possibility of alternative histories that are truly meaningful because they reveal details about

the fabric of Mycenaean life as experienced by most coastal and near-coastal dwellers. The scale of analysis appears to be justified because to a surprising extent, each region in the Mycenaean world was unique, due to the varied environmental and historical conditions that are expressed in the structure and contingency of the long-, medium-, and short-term processes of *annales* history. Just how striking these contrasts can be is shown in a brief comparative analysis of seven Bronze Age "settlement regions" on or near the North Euboean Gulf by Margaretha Kramer-Hajos (2008: 114–17). Despite being contiguous and occupying a relatively small part of Greece, they exhibit sharp differences in political organization, site types and locations, burial practices, monumental works, and other social and cultural characteristics. Surely this result validates the microregional framework of Horden and Purcell, and the focus of this book on the local and microregonal scale. Nevertheless, we must not lose sight of the bigger picture: the results of the analysis of coastscapes and small worlds form the robust data sets that can make big-picture and cross-cultural studies more than "cherry picking" from trait lists for superficial similarities and differences (Tartaron 2008: 134, 2010).

In the concluding chapter, I shall restate the main points of the study, and discuss prospects for future research along the same lines.

EIGHT

CONCLUSIONS AND PROSPECTS

In this brief concluding chapter I revisit a few central topics and offer some thoughts on where the approach advocated in this book might take us in the future.

A Conceptual Reorientation

During my twenty years of archaeological research in coastal areas of Greece, I have repeatedly confronted a disconnect between the usual narratives of Mycenaean maritime connectivity, focused on long-distance exchange and elite cargoes, and the lives I imagined for people living in the small coastal sites I often encountered in survey. Others had identified the same problem, albeit using different approaches. Horden and Purcell's (2000) attempt to write a history of the Mediterranean from the point of view of microregions and short-distance connectivity was an eye-opening inspiration, as was Broodbank's (2000) network analysis of small maritime worlds in the Cycladic islands. A group of archaeologists, among them Broodbank, Rainbird (2007), and Berg (2010), identified another problem in the segregation of land from sea, both conceptually and in fieldwork. As Berg (2010: 19) points out, the interest of continental and island surveys has generally stopped at the water's edge. To some extent, this problem arises because the sea–land divide is formalized in Greece by an administrative structure that places sea and land in the purview of two entirely separate authorities, with the result that permits to work on land do not extend to the sea and vice versa. Yet there is no intellectual justification for upholding this division. Islands are not in fact isolated "laboratories" of cultural

evolution, and the sea is not a flat and featureless "liquid plain" serving only as connective *space*, but rather it is a textured, richly humanized *place* permeated by opportunity and danger, and animated by daily activity and maritime lore. Land and sea are not experienced separately in coastal regions, so our studies should not compartmentalize them either.

To the extent that I have any evangelical agenda in this study, it is to advocate for a shift in scholarly attention to the local scale of coastscapes and small worlds. Many of the arguments for shifting focus to the local scale have already been made convincingly. Horden and Purcell (2000: 123) regard microregions as the basic units of connectivity that may coalesce in larger and larger aggregates that effectively cross-cut environmental zones and geographical scales, while Broodbank showed that even in the modest expanse of the Cycladic islands, a non-uniform and fluctuating pattern of local-scale maritime interactions over time distinctly affected the overall configuration of connectivity in the island chain in the EBA. A fundamental argument in the present work is that the interactions of daily life and travel occurred overwhelmingly at close range, yet the excessive attention to long-distance maritime networks has created gaps in knowledge of the local scale. As an antidote, the coastscape is offered not as a periphery or as a boundary between land and sea, but as a uniquely central and integrative place articulating terrestrial and maritime worlds. If we wish to characterize life for the vast majority of coastal dwellers in the Mycenaean period, coastscapes and small worlds are appropriate units of analysis.

Coastscapes and small worlds are no more isolates than are islands. Like the microregions of Horden and Purcell, they coalesce and fragment, form larger aggregrates by joining other small worlds, and then devolve once again into local entities. They are routinely affected or even transformed by external influences and events: the Saronic Gulf small world was profoundly affected first by the mysterious Middle Helladic hiatus, and later by the successive influences of the Minoans and the Mycenaeans. This multiscalar dynamism is a strong indication that a renewed interest in local-scale entities should not be misunderstood as a return to historical particularism. Moreover, robust data from local and regional scales safeguards against superficial characterizations when we attempt to write larger narratives of the Mycenaean world or the eastern Mediterranean, or mine the data for cross-cultural comparisons.

A Conceptual and Methodological Toolkit

It is not a simple matter to "find" a coastscape or a small world. We generally do not know where Bronze Age anchorages were: sites and anchorages may be lost to coastal processes, and there is no evidence as yet that Mycenaeans built durable harbor structures that might aid in identification. The Linear B tablets

tell us very little about coastal and maritime activity, and the LBA is too remote from Homer to hope that we can learn much from the epic poems. There is no surviving hull material from a Mycenaean boat, and the artistic representations depict a narrow range of seagoing vessels or are difficult to interpret.

These problems present theoretical and methodological challenges. It is first essential to recognize that coastscapes and small worlds are theoretical constructs devised by archaeologists to bring order to a world they know only dimly from fragmentary evidence. They have no empirical reality independent of our typological frameworks; thus, we *designate* coastscapes and small worlds, we do not *discover* or *recognize* them. The framework presented in Table 6.1 is a set of models that simplify and order spatial data in an attempt to illuminate the operation of maritime networks at contrasting scales. The difficulty I encountered in trying to define the geographical scales and their attributes reflects the complexity of human spheres of interaction: boundaries are fluid and porous, networks of different size and shape overlap in space, and change is constant. The best outcome for such a framework is that the individual models – each of the spheres of interaction a testable hypothesis – present a scenario that plausibly fits the distribution of artifacts and other material evidence, and that together credibly portray the complexity of a multiscalar system. As I pointed out, this particular framework is designed for the geographical and cultural milieu of the LBA Aegean; it would not likely be valid for other times and places without extensive modification. Yet it is a tool; I offer it here with the hope that it will be tested and refined as needed. Much of the benefit of the framework resides in the way it can facilitate systematic thought about a particular problem. It may be useful in thinking through research designs, and in interpreting results.

There is nothing shockingly new in the methods I propose, since there are long traditions in both archaeology and geoarchaeology of recovering the kinds of data that could lead to the reconstitution of coastscapes and small worlds. The collaboration of archaeologists and geoarchaeologists at Kalamianos is hardly unique, but it does illustrate how interdisciplinary research can restore the essential elements of a Bronze Age coastal world. In other settings, it may not be as easy to recover ancient shores or the settlements and activity areas associated with them. A striking outcome of a long-term program of paleogeographic reconstruction of western Peloponnesian coastlines is that Bronze Age sites along much of the coast, which existed in a lagoon and barrier environment, are now buried under colluvium, alluvium, and lagoonal mud (Kraft et al. 2005: 33–35). In such cases, geophysical remote sensing may assist in the recovery of lost sites. Most of these techniques are expensive and require lengthy analyses – even the rapid results of modern geophysical methods normally must be verified by excavation – but as I have emphasized throughout, it is difficult to reconstitute maritime networks at any scale without baseline

information on the Bronze Age configuration of the coastline in the area of interest.

Maritime Coastal Communities

The maritime activities of coastal inhabitants are elusive. We learn little about them from the Linear B tablets, apart from a few cases of shipbuilding and rowing in state-controlled ships. The archaeological record contains limited faunal and artifactual evidence for the use of marine resources (Powell 1996), and the results of stable isotope analyses have not yet demonstrated a significant contribution of marine protein to the diet of individuals at coastal sites (Petroutsa and Manolis 2010; Triantaphyllou et al. 2008). This appears to fly in the face of reason – depictions of fish and fishing on pottery and the frescoes of fishermen at Akrotiri tend to inspire greater confidence. Perhaps further development of the methods and standards used for the stable isotope studies (Hedges 2004), and more careful excavation recovery methods, will resolve this contradiction.

I chose to focus on three related aspects of maritime activity: navigational skill, the transmission of maritime knowledge across generations, and the organization of maritime activity within the larger social setting of the coastal community. I proposed that two types of individuals were active on the sea: non-specialized fishermen and farmers operating in inshore waters and traveling to nearby destinations; and master navigators who were capable of directing long sea voyages beyond the confines of the small world. Hesiod, with his short crossings to Euboea, is representative of the first group, while Homer's hard sea captains belong to the second. This division too is fluid, but it agrees with ethnographic information from the South Pacific, where most sea travel is local and only a small percentage of men attain the status of master navigator capable of leading long voyages.

Ethnographic data are informative on the other two aspects. Among South Pacific islanders, navigational knowledge is sophisticated and is protected within the maritime community – a subset of the larger village community – by physical segregation in boathouses and at sea, and by an esoteric and secret body of maritime knowledge and lore. Part of this lore involves vivid stories about markers and hazards en route to specific destinations. I suggested that the stories of hideous monsters and conspicuous burial tumuli in the *Odyssey* might be echoes of the kinds of maritime lore shared about distant and unfamiliar places in the Bronze Age. Specialized expertise in the mechanics of navigation and the features of specific itineraries constituted a habitus of maritime knowledge that was vital to the success of the maritime community, and it is not surprising that we should find traces of it embedded in metaphorical tales. Although there are no equivalent structures in the Mycenaean world, the Minoan ship

sheds may have served a secondary function as meeting places for the seafaring community.

Building Networks

The network analyses of Broodbank (2000), with updates and modifications suggested by Knappett and colleagues (2008, 2011) and Leidwanger (2011), are promising advances toward an understanding of how networks actually form, expand, and contract. The more recent versions address specific shortcomings by adding a range of cultural and environmental variables, the values of which can be altered individually or covaried to simulate different conditions (Knappett), and by adding texture to the sea to produce more realistic travel times (Leidwanger). The social network studies of Duncan Watts and Steven Strogatz (Watts 1999; Watts and Strogatz 1998) and Albert-László Barabási (Barabási 2002; Barabási and Albert 1999) examine the behavior of networks, showing how shortcuts extend networks over long distances, and explaining why some sites are perennially better connected than most others, and expand in connectivity more rapidly than others. I suggested that these properties of social networks may help to explain the prominence of Knossos, Mycenae, and Kolonna at various moments in prehistory. Human behavior can be difficult to model, however, and social network models as they currently exist for the Aegean can be described as a work in progress.

A Universe of Coastscapes and Small Worlds

Malkin and colleagues (2007: 7) record a pithy quote from Barabási: "Networks are present everywhere. All we need is an eye for them" (Barabási 2002: 7). The same can be said for coastscapes and small worlds; if there is a central message to this book, it might be expressed in the exhortation: "They are out there; go out and find them!" Bearing in mind that assigning a coastscape or small world is an act of interpretation and not observation (one does not really "find" them), the number of Mycenaean maritime small worlds one could investigate is practically unlimited. It primarily requires a shift in thinking about the archaeological record in terms of maritime cultural landscapes. Several archaeologists have already put a comparable approach to work, as, for example, Momigliano (2005) for the vicinity of Iasos in the southeastern Aegean and Crielaard (2006) and Kramer-Hajos (2008) for the Euboean Gulf. Other possibilities come immediately to mind. The Argolic Gulf would be a challenging case study, because of the complex and ambiguous nature of the relationships of the major sites around the Gulf and further inland (Mycenae, Midea, Tiryns, Argos, Asine, Lerna, Nafplion, etc.; see Sjöberg 2004; Voutsaki 2001, 2010). Although important paleocoastal work has been accomplished (Zangger 1991, 1993, 1994a, 1994b),

the lack of systematic surface survey on much of the territory bordering the Gulf hinders discussion of the human landscape. Another large study might target the western Messenian coast of the Peloponnese, drawing upon the rich combination of archaeological survey and excavation, geoarchaeological studies, and the Pylian Linear B archives (Bennet 1999; Bennet and Shelmerdine 2001; Davis 1998; Zangger et al. 1997). On Crete, the Gulf of Mirabello and the Isthmus of Ierapetra, with the sites of Mochlos, Pseira, Kavousi, Gournia, and Vrokastro, would make an intriguing study. As much as anything, limitations of space prevent me from pursuing these case studies in the present work.

This book presents a set of methodological and conceptual approaches to support a particular vision of coastal archaeology, and strives to demonstrate what that approach would look like when applied to archaeological case studies. Despite the broad awareness of a comprehensive agenda for island archaeologies (Broodbank 2000; Rainbird 2007) and maritime cultural landscapes (Westerdahl 1992), the translation of these ideas into practice has been slow, as Berg (2010) stresses. I have tried to be equally explicit in defining an archaeological problem – a lack of balance in our knowledge of the Mycenaean maritime world – and offering a complete set of tools to attack it. I hope to stimulate discussion, but even more to encourage new field studies and analyses inspired by the maritime cultural landscape concept.

NOTES

Chapter 2: Mycenaeans and the Sea

1 There are other useful frameworks that address the same issue. For example, Bernard Knapp and John Cherry (1994: 123–55) simplified Renfrew's list with four overlapping mechanisms of Late Bronze Age trade that emphasize the locus of control: centralized control, localized control, freelance trade, and gift exchange.

Chapter 3: Ships and Boats of the Aegean Bronze Age

1 McGrail (2001: 133) notes, however, that Egyptian shipwrights already knew of locked mortise-and-tenon joinery in the mid-third millennium BC, as superstructural elements of the Khufu funerary boat used the technique. It is uncertain why they chose not to join the hull planks in this way.

2 According to McGrail (2001: 138), in the Mediterranean even sewn ships relied to some extent on treenails or mortise-and-tenon fastenings within the seams with lacings across the seams. Thus, the status of an ancient Mediterranean tradition of solely sewn hulls comparable to that of northwestern Europe is uncertain.

3 The use of a pole for propulsion, known from Bronze Age Egypt but more suitable in riverine contexts, cannot be confirmed for the Aegean. Uniquely, the Stathatos seal (W910), of MM III–LM I date, may show two females poling a vessel that also has five oars below the hull.

4 There is enormous confusion about the relationship between the terms *steering oar* and *quarter rudder*, starting from their very definitions. There appears to be no universal agreement; depending on the source, they can be synonyms, hierarchically related (one is a kind of the other), or completely distinct (the rudder developed from and superseded the steering oar). For different perspectives, see Block 2003: 8–9; Mark 2005: 121–22; Mott 1991: 2; and Runyan 1999. Because most studies of Aegean Bronze Age ships use the term *steering oar*, with some justification, I follow that convention here.

5 A painted ceramic disk, recently discovered at As-Sabiyah in Kuwait in a context contemporaneous with Ubaid 3, the second half of the fifth millennium BC, depicts a boat with a bipod mast but no visible sail (Carter 2006). If we assume a sailing vessel, this would now be the earliest known use of mast and sail.

6 The gradual migration of the sail toward amidships in Egypt can be traced in representations from the Old to the New Kingdom: Jones 1995: 36–51, Plates V, VI, and VIII; Raban and Sterlitz 2002: 655.

7 The painted larnax from Gazi, Crete (W608) is a potential exception if the LM IIIB date is correct.

8 Note should also be taken of the so-called talismanic glyptic representations of ships, bearing stylized, abstract elements on and above hulls that could be sails, awning structures, *ikria* (see below), or other structures. These enigmatic images, with a chronological range between MM III and LM II, have long been associated with ritual and magic (Wedde 2000: 134–41).

9 These "types" are of course the creation of modern observers. Apart from possibly failing to approximate the way Mycenaean people formed distinctions about watercraft, they very likely suppress real variability (see below).

10 I am grateful to Hariclia Brecoulaki and Sharon Stocker for allowing me to mention the naval fresco, and for sending me an image of it in advance of publication.

11 I am grateful to Michael Cosmopoulos for his kind correspondence concerning the Iklaina fresco fragment, and for sending me a copy of the paper cited here.

12 The assumption that the highly abstracted form of the stempost device of the Iron Age continues to represent a bird, in a unbroken chain of continuity from Mycenaean times (Wachsmann 1998: 177–97), is challenged by Wedde (2002: 837–43), who interprets abstract curving devices of the Iron Age as horns.

13 de Souza (2000: 16) advances a more extreme view that does not recognize coastal plundering as piracy: "People using ships to plunder coastal settlements are not called pirates, so they cannot really be said to be practising piracy." His subsequent discussion of Homeric and other sources appears to contradict this position.

14 This question forms part of a greater inquiry into strategies of self-representation among ruling groups. The Minoan and Mycenaean civilizations did not share the Egyptian and Near Eastern propensity for iconographic and narrative emphasis on individual rulers, for example. Several archaeologists have modeled these contrasting tendencies in terms of "network" (centralized, exclusionary) vs. "corporate" (decentralized, inclusive) strategies of leadership and self-representation (Blanton et al. 1996; Feinman 2000). The Mycenaeans, with their sharply hierarchical social structure revealed in the Linear B archives, are usually placed farther toward the "network" end of this spectrum than the Minoans: Borgna 2004; Parkinson and Galaty 2007.

15 This orientation may be partially a consequence of the inward-focused Middle Bronze Age societies from which they emerged.

16 Mention should also be made of the remains of a small wooden boat of the EBA–MBA transition recently discovered at Mitrou in central Greece (Van de Moortel and Zahou 2009). Conservation of this find is ongoing and little information is available at present.

17 This discussion does not take into account fishing in rivers or lakes. Because few rivers in Greece are perennial, especially in the southern and central regions and the Aegean islands, they are not a significant source of fish. Lakes of substantial size are also relatively few in Greece, but these presumably would have been well stocked with fish. The eels from Lake Kopais were an especial delicacy in classical times (Aristophanes, *Acharnians* l. 940–950; Pausanias 9.24.2; see Vika et al. 2009). Kopais was partially drained in the Mycenaean palatial period to reclaim land for agriculture (Knauss 2001).

18 Wedde's assessment is, of course, built upon the assumption that the artists tried to approximate the dimensions of real vessels of which they had some knowledge.

19 The sailing estimate from Crete to Egypt is based in part on a reference in the *Odyssey* (14.255–57) in which a sailing ship from Crete riding a fresh north wind made the Nile delta on the fifth day. The underlying assumption is that the performance traits of Aegean Bronze Age sailing ships were similar to those described by Homer. In view of the gradual development of ships like the Mycenaean galley in the Early Iron Age, this assumption has some validity.

20 Tilley (1999: 423) defines a *true* sailing ship as " . . . one that can make *some* headway under sail up wind" (italics in original), and continues, "I would like to distinguish it as sharply as possible from a galley." Modern sailing boats are not considered capable of sailing directly into the wind, and so must undertake tacking maneuvers at various angles to windward.

21 Tzalas (1995b: 453–54) also suggests technical improvements that would increase speed and minimize the rather excessive drift that the canoe experienced. These steps might reduce travel time somewhat.

Chapter 4: The Maritime Environment of the Aegean Sea

1 A thorough and highly readable account by Jamie Morton, *The Role of the Physical Environment in Ancient Greek Seafaring* (Morton 2001), covers most of this ground in far more detail than is possible here. His work, however, focuses on the historical period and to a large extent provides a commentary on a wide range of textual references to Aegean seafaring found in literature from Homer to the Roman period. Some of the conditions of seafaring that he describes – for example with respect to ships, navigational knowledge, and the organization of maritime trade – were quite distinct from those that prevailed earlier in the Mycenaean period. Nevertheless, this is important source material and most of his observations on the seafaring environment remain valid for the Bronze Age.

2 During a recent junior world championship sailing event in the Thermaic Gulf at Thessaloniki in July 2009, the competition was forced off the water by a strong vardari wind: http://470.org/content.asp?id=1700, accessed March 24, 2010.

3 The recent discovery of Lower Paleolithic habitation in the Plakias region of Crete, an island for at least the last five million years, implies open-sea navigation at least 130,000 years ago: Strasser et al. 2010. If confirmed, these results will have a profound impact on our knowledge of early seafaring and the dispersal of early humans.

4 Several periploi are extant in fragmentary or near-complete form. Among the more complete are The Periplus of Hanno the Navigator (sixth century BC), The Massaliote Periplus (sixth century BC?), The Periplus of Pseudo-Scylax (fourth or third century BC), The Periplus of Scymnus of Chios (late second century BC), The Periplus of the Erythraean Sea (first century BC), and the Periplus Ponti Euxini (early second century AD). The following passage from the Periplus Ponti Euxini, written by Arrian (best known for his history of Alexander the Great), exemplifies the use of these features as segments in a longer journey:

> From the Phasis, we passed the navigable river Charies; there are 90 stades between the two. From the river Charies, we sailed on another 90 stades to the river Chobos, and there we anchored. . . . From the Chobos, we passed the navigable river Sigame; it is approximately 210 stades from the Chobos. After the Sigame is the river Tarsouras; there are 120 stades between the

two. The river Hippos is 150 stades beyond the
Tarsouras, and the Astelephos 30 beyond the Hippos.

(10.i–iii; transl. A. Liddle)

5 In this regard, it is interesting that one of the contingents of rowers listed on An 610 came from the island of Zakynthos and may have held mercenary status.

6 Hesiod himself had sailed only as far as Euboea, a short crossing from the mainland, and as a passenger at that. The advice he dispenses about the sea is common wisdom; he can hardly be said to have any specific knowledge about seafaring. The implication that land-locked farmers regularly owned ships and took to the sea is intriguing, but we cannot tell from this passage how far they ventured. According to the model presented in this book, these must have been relatively short-distance voyages, for reasons of knowledge but also because perishable commodities would not keep for long.

7 Tim Severin (1985: 132–44) gives a vivid description of the extraordinary difficulties of passing through the Bosporus from the Dardanelles in the *Argo*, a reconstructed "Bronze Age" twenty-oared galley.

Chapter 5: Coasts and Harbors of the Bronze Age Aegean: Characteristics, Discovery, and Reconstruction

1 The main area of disagreement I have with Morton (2001) and Papageorgiou (2009) concerns the pervasiveness of coastal change, especially of tectonic origin, and the importance of identifying coastal configuration at a specific, local scale. They are right that in general the processes of change are the same as in the past (by simple uniformitarian principles) and that the same range of coastal features existed in the Bronze Age as do now. But I believe that coastal change is more dynamic than they allow, resulting in shifting anchorages over time, and I hope to argue persuasively in this chapter for acquiring detailed knowledge of local coastal settings as a necessary first step toward understanding Mycenaean maritime networks at all scales.

2 *Isostasy* refers to the rebound of land masses formerly under ice sheets, causing a drop in relative sea level (isostatic compensation) in glacial margins. Because this is not a process that affects the Mediterranean, I do not consider it further.

3 Tanner (1995) outlines an alternate mechanism in which the ridge and swale sets are formed by a sea-level rise-and-fall couplet with amplitude from 5 to 30 centimeters.

4 Although similar in plan, the Minoan structures differ from later Classical ship sheds in their location away from the shore; thus, they were not used for launching ships as were the Classical ship sheds (Shaw and Shaw 1999: 369).

5 It may be significant that Ellen Davis (2007) considers the Ayia Irini frescoes to have been painted by traveling Cretan artists.

6 Van de Noort and O'Sullivan (2006: 36–37) emphasize that certain types of biogenic wetlands, notably peatlands, actually rank among the poorest biomass producers in the world because of saturation, which deprives plants and animals of nutrients, and high acidity. Mediterranean wetlands generally have a riverine or estuarine origin, with high biomass and biodiversity.

7 Here I use this term in a generic sense to indicate the recovery of a continuous core; see Rapp and Hill 1998: 192–94 for distinctions among the terms *coring*, *drilling*, and *augering*.

8 Other biogenic clasts, including diatoms and pollen, are not included here as they have not played a significant role in paleocoastal reconstruction to date. For details, see Marriner and Morhange 2007: 170–71.

Chapter 6: Concepts for Mycenaean Coastal Worlds

1 Brad Duncan (2006: 10) points out that although Westerdahl coined a term that has come into common use, a long tradition of ethnographic, archaeological, and anthropological research in the Pacific had already addressed many of the same issues using oral traditions, toponymy, and specialized local knowledge to illuminate identity and belonging to place among maritime communities.
2 W. V. Harris (2005: 6, n. 15) observes that while the microregion is a central concept in *The Corrupting Sea*, it is nowhere defined explicitly enough to prevent ambiguity in attempting to apply it.
3 Constantakopoulou (2007: 231) acknowledges that the term *peraia* has a broader application to any region that is controlled or possessed by a state. The narrower sense employed here is, however, the most commonly attested.
4 Here we must treat Crete as a mainland or mini-continent, and not an island. It has not been suggested that the small islands off the Cretan coast possessed peraiai; rather, islands such as Mochlos and Pseira acted as "gateways" to harbors on Crete's northern coast (Betancourt 2004; Betancourt and Banou 1991; Branigan 1991).
5 Malkin's important book, which incorporates his prior work on colonization, cross-cultural interaction, identity, and ethnicity into a network theory framework, arrived too late for me to consider in detail in the present work.
6 Leone Porciani (2009) observes that Horden and Purcell tend to emphasize peaceful relations, while underplaying the role of aggressive and hostile interactions.
7 This summary of Broodbank's PPA model is partly excerpted from Tartaron 2001b: 228.
8 For an overview of the intellectual history of network analysis, see Scott 1991: 7–38.

Chapter 7: Coastscapes and Small Worlds of the Aegean Bronze Age: Case Studies

1 Because changes in the coastline at a local scale since the Bronze Age can be considerable, this statement should be qualified simply by keeping in mind that today's good anchorages need not be the same as those in the Bronze Age, but on average anchorages of comparable kind and quality were available.
2 If the story that the hoard was found in the nineteenth century in a LH IIIB chamber tomb on Windmill Hill is correct, this would mean that the hoard was originally looted in the Bronze Age and redeposited in the chamber tomb, or that it was preserved as an heirloom collection for several hundred years before its ultimate deposition in the LH IIIB burial.
3 The contributors to Fitton 2009 do not come to a consensus about the date of the Aigina Treasure, though a date between later MH I and MH II seems to be favored. The treasure and the shaft grave are not so readily comparable because the artifact composition between a jewelry hoard and a warrior burial are functionally distinct. Hiller (2009) believes that the gold objects from the two contexts represent different traditions, one Minoan (the jewelry of the Aigina Treasure) and one from the mainland (the shaft grave).
4 Much of the following discussion closely follows excerpts from Tartaron 2010: 171–72 and Tartaron et al. 2011, with some modifications and additions. These recent writings continue to reflect my current thinking on the matter.
5 The Saronic Harbors Archaeological Research Project is carried out under the auspices of the American School of Classical Studies at Athens, with the approval of the 37th Ephoreia of Prehistoric and Classical Antiquities and the 25th Ephoreia

of Byzantine Antiquities, and a permit issued by the Greek Ministry of Culture. For their kind support, we wish to thank Konstantinos Kissas and Panayiota Kasimi from the 37th Ephoreia and Demetrios Athanasoulis from the 25th Ephoreia. We gratefully acknowledge financial support from the Institute for Aegean Prehistory, the U.S. National Science Foundation (Grant BCS-0810096), the Stavros S. Niarchos Foundation, the Loeb Classical Library Foundation, the Arete Foundation, the Florida State University, the University of Pennsylvania, and Norwich University.

6 Investigations of the underwater areas of Kalamianos and the Korphos Bay region are undertaken as a joint Greek-Canadian project, under the direction of Despina Koutsoumba of the Ephoreia of Enalion Antiquities and Joseph Boyce of McMaster University, representing the Canadian Institute in Greece. This project is independent of, but in close cooperation with, SHARP.

7 The reconstructed shoreline positions are approximations based on the *modern* bathymetric contours and do not take into account the effects of sediment accumulation and compaction following the submergence of the beachrock platforms. These parameters will be clarified in future studies.

8 Amy Dill and D. J. Pullen, personal communication. A number of samples have been selected for a future program of petrographic and chemical analysis aimed at clarifying the source of the potting materials as well as aspects of production and consumption.

9 Recent discussions with colleagues have raised the likelihood that similar cairns may exist in many places in southern Greece that have not previously been recognized as EBA features.

10 The interviews were much more extensive than those I consulted here. The oral histories will be the subject of future publication by Tzortzopoulou-Gregory.

11 For a brief but vivid description of a traditional charcoal-burning operation in the Souli region of southern Epirus, see Newby 1998: 168–170.

12 In the post-Bronze Age era, the progradation was asymmetrical, with the bifurcation of the Maeander into northern and southern branches, of which the northern branch caused a far more rapid advance of the coastline in the northern and central Gulf than in the south (Knipping et al. 2008: fig. 1; Müllenhoff et al. 2005).

13 Another tholos tomb was discovered at Kazanaki, but it is sufficiently distant from the settlements under discussion that it may have been attached to an undiscovered settlement.

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INDEX